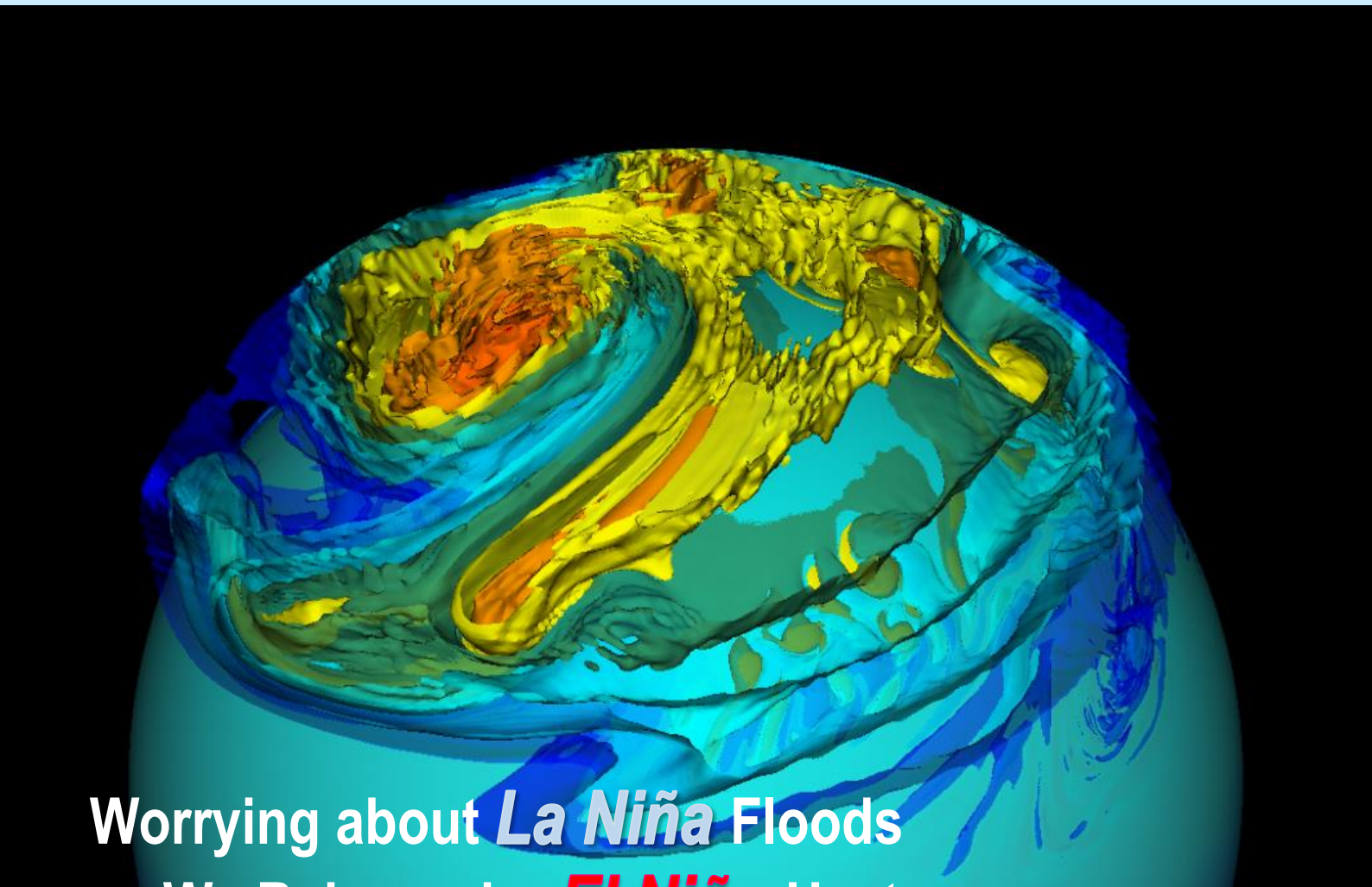
Volume 16 Number 1 2016

UNIVERSITY OF MALAYA RESEARCH

Bulletin



Worrying about *La Niña* Floods as We Bake under *El Niño* Heat

Congratulations

MTE and ITEX 2016 Winners

A Personal Recollection on NMR Spectroscopy

UNIVERSITY OF MALAYA
111
YEARS
1905 - 2016

UNIVERSITY OF MALAYA
ACADEMIC CALENDAR FOR SESSION 2016/2017

SEMESTER I				
Orientation week	1 week	28.08.2016	-	04.09.2016
Lecture	7 weeks	05.09.2016	-	21.10.2016
Mid-Semester Break	1 weeks	22.10.2016	-	30.10.2016
Lecture	7 weeks	31.10.2016	-	16.12.2016
Revision Week	1 week	17.12.2016	-	25.12.2016
Examination	3 weeks	26.12.2016	-	14.01.2017
Semester Break	4 weeks	15.01.2017	-	12.02.2017
TOTAL	**24 weeks**			
SEMESTER II				
Lecture	7 weeks	13.02.2017	-	31.03.2017
Mid-Semester Break	1 week	01.04.2017	-	09.04.2017
Lecture	7 weeks	10.04.2017	-	26.05.2017
Revision Week	1 week	27.05.2017	-	04.06.2017
Examinations	3 weeks	05.06.2017	-	24.06.2017
TOTAL	**19 weeks**			
SESSION BREAK/SPECIAL SEMESTER				
Semester Break	9 weeks	25.06.2017	-	27.08.2017
	or			
Lecture and Examination	8 weeks	28.06.2017	-	20.08.2017

Public holidays:

National Day (31 August 2016)

Aidil Adha Public Holiday (12 September 2016)

Malaysia Day (16 September 2016)

Maal Hijrah (2 October 2016)

Deepavali (29 October 2016)

Prophet Muhammad's Birthday (Maulidur Rasul) (12 December 2016)

Christmas (25 December 2016)

New Year (1 January 2017)

Chinese New Year (28 & 29 January 2017)

Labour Day (1 May 2017)

Wesak Day (10 May 2017)

Nuzul Al-Quran (12 June 2017)

Aidilfitri (26 & 27 June 2017)

PREFACE

Assalamualaikum and hello again everyone. This year marks the 111th year of University of Malaya since its inception on the 28th September 1905 as the King Edward VII College of Medicine. The research and innovation culture in UM has also been evolving in tandem with the university's growth. Starting with small grants, known as the "Vote F" funded through the University's Research Fund, to IRPA and Science Funds by MOSTI to Research University, HIR and Fundamental Grant Funds by MOHE, the passion for research and innovation amongst UM's researchers has grown from strength-to-strength, leading to UM currently being the premier research university in Malaysia. I would like to take this opportunity to thank everyone involve, in particular, the hard-working and innovative UM researchers for making UM the best research university in Malaysia and also for putting UM on the research map globally. Without your efforts, this would not have been possible. This year, we are faced with a major challenge in securing enough funds to run all our research projects and activities. Nevertheless, we, the R&I team, would like to assure researchers that we will continue to work hard in aiding researchers secure research grants, especially from external source so that your research activities can go on. We will, however, need all the cooperation and support from everyone to make this a reality for all researchers. I am confident that true to the UM's Spirit of "being the best", we will overcome these challenges and continue to be the premier research university in Malaysia. Thank you.

Prof. Dr. Noorsaadah Abd Rahman
Deputy Vice-Chancellor
(Research & Innovation)
University of Malaya

Prof. Dr. Shaliza Ibrahim
Associate Vice-Chancellor
(Research & Innovation)
University of Malaya

Assalamualaikum & Warm Greetings to everyone. Congratulations to the UMR Bulletin team for the publication of the current issue, which is referenced as Volume 16, Number 1 for the year 2016. The publication number has now been included, in line with the correct use of periodical publication terminology, and to facilitate referencing and citation of UMR Bulletin articles by future authors. Our heartfelt thanks go to all article contributors. The current issue features an article entitled "Worrying about La Niña Floods as We Bake under El Niño Heat" by Prof. Dato' Dr. Azizan Abu Samah highlighting the issues of climate change, which may have affected us directly especially after the recent (May 2016) major flash flood in Pantai Valley. I would also like to record my appreciation to Prof. Emeritus Dr. Ng Soon for sharing his experience in managing NMR spectroscopy in University of Malaya. As in the previous years, UM has taken part in the Malaysia Technology Expo (MTE) 2016 and the International Invention & Innovation Exhibition (ITEX) 2016. Our teams have made us proud with their medals and Special Awards - heartiest congratulations to the winners! Write-ups for the winning entries are included here. This year we have already gone through two audits, the MyRA audit in April and the UM QMS (ISO 9001) audit in May; and I wish to personally thank everyone for their hard work in ensuring that everything went smoothly during the audits. This is my first preface since serving as Associate Vice-Chancellor (Research & Innovation) and I hope that research at UM will continue to expand and flourish in this time of new challenges. I would like to welcome and congratulate new appointments under the R&I portfolio and express our sincere gratitude to those who have left the management team. We look forward to working with everyone in striving to provide the best support for our researchers.

Have a blessed Ramadhan!

Editorial Message

This is my first year taking over from Prof. Dr. Thong Kwai Lin as the director of the Centre for Research Services. It is a pleasure to find that the centre has been functioning efficiently for the past few years, facilitating my transition into the current role. The UM Research Bulletin aims to promote and enhance research visibilities of our researchers and it is a product of concerted effort by UM researchers and the editorial team with the provision of printing services by the Centre for Research Services. Without the research bulletin, the promotional role of the centre will be incomplete.

I would like to extend my greatest appreciation to all article contributors and the editorial board in featuring well selected articles on "La Nina Floods" and "El Nino Heat", MTE and ITEX winning research projects, an awarded best research paper focusing on an old Malay folk story - *Hikayat Malim Dewa* to discuss a new approach in cross disciplinary research, University of Malaya's high impact publication in Chemical Reviews on "Superoxide Ion" and also a nostalgic recollection of NMR Spectroscopy and its evolution. Apart from that, a useful library guide is also included in the bulletin for UM campus community to have better access to its resources. I hope the present issue can further elevate the interest of our readers.

Enjoy reading and see you again in the next issue!

Thank you.

Assoc. Prof. Dr. Ngoh Gek Cheng
Director, Centre for Research Services

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CONTENTS

Cover Photo : https://www.walldevil.com/363614-climate-models-wallpaper.html

MTE 2016 Winners

University of Malaya scored a big success with a total of 14 awards (one Best Award, one INNOPA Special Award, six Gold Medals, three Silver Medals and three Bronze Medals) at the Malaysia Technology Expo (MTE) 2016 held from 18-20 February 2016 at the Putra World Trade Centre, Kuala Lumpur. MTE is an international invention and technology expo in the region and this year marked the 15th years since its first inception in 2001. This annual expo displayed more than 500 exhibits (inventions, ideas and designs) by inventors, scientists and researchers from all over the world.

University of Malaya sent 12 teams comprising of academic staff and students to participate in MTE 2016. One of the projects entitled "BioPE-DSSC: Biopolymer Electrolyte Based Dye-Sensitized Solar Cells as Green Energy Source" led by Dr. Ramesh Kasi from the Center for Ionics University Malaya (C.I.U.M), Department of Physics bagged the Gold Medal and The Best Award while a project entitled "OsteoKneeTM" led by Ir. Dr. Lai Khin Wee from the Department of Biomedical Engineering bagged the Gold Medal and the INNOPA Special Award (Indonesian Invention and Promotion Association).

Fig. 1: Winners and representatives at MTE 2016.

The details of the winning projects are as follows:

Gold Medal & Best Award
Project : BioPE-DSSC: Biopolymer Electrolyte Based Dye-Sensitized Solar Cells as Green Energy Source
Researchers : Dr. Ramesh Kasi (PI), Dr. Mohammad Hassan Khanmirzaei, Prof. Dr. Ramesh T. Subramaniam, Dr. Vengadaesvaran Balakrishnan, Mr. Ng Hon Ming, Mr. Mohd Zieauddin Kufian & Prof. Dr. Abdul Kariem Arof
Email: rameshkasi@um.edu.my

Gold Medal & INNOPA Special Award (Indonesian Invention and Promotion Association)
Project: OsteoKnee™
Researchers: Ir. Dr. Lai Khin Wee (PI), Assoc. Ir. Dr. Belinda Murphy, Dr. Goh Siew Li, Yong Ching Wai, Victor Kean Shern Phng & Haw Yu Hong
Email: lai.khinwee@um.edu.my

Gold Medal
Project: Germanium Flat Fiber Dosimetry: a new intelligent material for radiation detection and measurement forming a highly versatile wide-spectrum detector of unsurpassed capability
Researchers: Prof. Dato' Dr. Mohd Jamil Maah (PI), Prof. Dr. Yusoff Mohd Amin, Dr. Siti Fairus binti Abdul Sani, Dr. Alawiah binti Ariffin, Siti Shafiqah binti Ahmad Shaharuddin, Prof. Dr. Hairul Azhar Abdul Rashid & Dr. Nizam Tamchek
Email: mjamil@um.edu.my

Gold Medal
Project: Development of a New CNC Gantry Machine with Double Motion Feed Drive System
Researchers: Dr. Noor Azizi Mardi(PI), Dr. Ahmed Aly Diaa Mohammed Sarhan, Prof. Dr. Hamdi Abdul Shukor, Javad Akhbari, Dr. Mohammad Reza Movahhedy, Seyed Reza Besharati, Abdul Hadi Jalaludin, Dr. Mohd Sayuti AB Karim & Wan Nur Izzati Wan Badiuzaman
Email: azizim@um.edu.my

Gold Medal
Project: Portable Modular Electrical Discharge Machine (EDM) for Micro Application
Researchers: Dr. Azuddin Mamat (PI), Prof. Dr. Imtiaz Ahmed Choudhury, Prof. Dr. Zahari Taha & Dr. Yap Hwa Jen
Email: azuddin@um.edu.my

Fig. 2: University of Malaya booth visit. From left, YBhg. Prof. Dato' Dr. Mohd Jamil Bin Maah (UM), YB Datuk Seri Panglima Madius Tangau (Minister, Ministry of Science, Technology and Innovation, MOSTI), Prof. Dr. Shaliza Ibrahim (UM) and Dr. Wan Manshol Bin W. Zin (Malaysian Association of Research Scientists, MARS).

Gold Medal
Project: SmartDhesionPE: Smart Adhesion Polymer Electrolyte for Electrical Energy Development
Researchers: Prof. Dr. Ramesh T. Subramaniam (PI), Prof. Dr. Abdul Kariem Arof, Dr. Ramesh Kasi, Ms. R. Shanti Rajantharan, Mr. Ng Hon Ming, Mr. Mohd Zieauddin Kufian, Dr. Vengadaesvaran Balakrishnan, Dr. Ezra Morris Abraham Gnanamuthu, Dr. Chee Swee Yong, Dr. Mohamad Hassan Khanmirzaei, Prof. Dr. Ramesh Singh
Email: ramesh@um.edu.my

Silver Medal
Project: CAHAYA: 2 Micron Q- Switched Fiber Laser
Researchers: Prof. Dr. Sulaiman Wadi Harun (PI), Prof. Dr. Harith Ahmad, Mohamad Badrol Hisyam bin Mahyuddin, Anas bin Abdul Latiff & Ir. Hanafiah bin Shamsuddin
Email: swharunum.edu.my

Silver Medal
Project: Smart Outdoor Lighting System with Emergency Beacon, Flood Warning Transmission System and Security Camera
Researchers: Assoc. Prof. Dr. Chong Wen Tong (PI), Prof. Dr. Masjuki Bin Haji Hassan, Dr. Chan Chee Seng, Assoc. Prof. Dr. Ngoh Gek Cheng, Dr. Tey Kok Soon, Mr. Wong Kok Hoe, Mr. Alireza Esmaeilzadeh, Mr. Ahmad Fazlizan Abdullah, Mr. Mohammed Gwani & Mr. Wan Khairul Muzammil Abd Rahim
Email: chong_wentong@um.edu.my

Silver Medal
Project: Acceleration of Wound Healing Potential by Salicylic Acid Loaded Lipid Nanoparticles
Researchers: Prof Dr. Misni Bin Misran (PI), Prof Dr. Hapipah Binti Mohd Ali, Prof Dr. Mahmood Ameen Abdulla & Dr. Maryam Hajrezaei
Email: misni@um.edu.my

Bronze Medal
Project: A Novel Desulphurization Method Using In-Situ Generated Superoxide Ion in Ionic Liquids
Researchers: Prof. Dr. Mohd Ali Hashim (PI), Dr. Maan Hayyan, Dr. Adeeb Hayyan & Eng. Muna Hassan Ibrahim
Email: alihashim@um.edu.my & en_adeeb1@yahoo.com

Bronze Medal
Project: A Dual Function Anti Vibration System (Chevron Viscoelastic Damper, CVD) for Vibration Response
Researchers: Dr. Meldi Suhatril (PI), Seyyeded Saghar Ghodsi, Mohammad Hossein Mehrabi & Hamed Khatibi
Email: meldi@um.edu.my

Bronze Medal
Project: mySMART Leg: In-socket Sensory System
Researchers: Dr. Nur Azah Binti Hamzaid (PI), Farahiyah Binti Jasni, Nur Hidayah Binti Mohd Yusof, Anur Diyana Binti Abu Bakar, Hanie Nadia Binti Shasmin & Zafirah Binti Zakaria
Email: azah.hamzaid@um.edu.my

Fig. 3: Prof. Ramesh receiving the award.

Worrying about *La Niña* Floods as We Bake under *El Niño* Heat

El Niño - Southern Oscillation (ENSO) is the most dominant tropical oscillation responsible for inter-annual, or year-to-year, climate variability across the globe. This oscillation is an important mechanism for climate variability in transporting heat from the tropics to the higher latitudes.

During an El Niño/La Niña event, warmer/cooler than the normal sea surface temperatures (SST) occur in the central and western equatorial Pacific, while cooler/warmer than the normal SST are observed in the eastern part of the tropical Pacific. El Niño and La Niña tend to occur in alternate irregular cycle, which is called as the El Niño - Southern Oscillation (ENSO) cycle. El Niño episodes occur during the northern hemisphere spring season with an approximate periodicity of 3-5 years and each episode usually lasts for 9 -12 months. On the other hand, a La Niña event may last 1-3 years. Years when neither El Niño nor La Niña is present are referred to as neutral period.

Figure 1 illustrates the SST anomaly pattern during a strong El Niño event in 1997-1998. The area shaded in red denotes warmer, above average SST temperature across the eastern tropical Pacific. Thunderstorms and rain tend to be widespread and intense over the region of warmest SST and these areas of warmer SSTs coincide with the regions of above-average tropical rainfall.

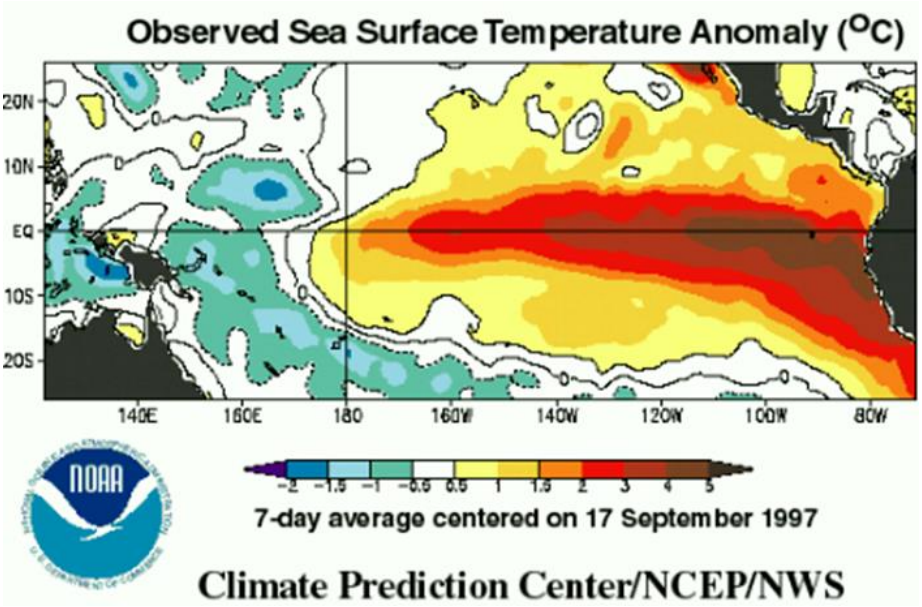

Fig. 1: SST anomaly pattern over the equatorial pacific during an El Niño event of the 1997-1998 year. (Source: Climate Prediction Centre NOAA)

Figure 2 shows SST pattern during a La Niña event in 2010. During the La Niña, SST averages below normal over the west coast of South America and towards the Pacific in the form of a cold tongue (blue shaded) while warm SST is located in the western Pacific region. The region with below-average SST coincides with the area of well below-average tropical rainfall.

ENSO conditions can be monitored using sea surface temperature (SST) anomalies in 4 geographic regions of the equatorial Pacific (Fig. 3). SST anomalies equal to or greater than 0.5 °C (0.9 °F) in the Niño 3.4 region (comprising portions of Niño regions 3 and 4, from 170 °W to 120 °W longitude) are indicative of ENSO warm phase or El Niño conditions. SST anomalies less than or equal to −0.5 °C (−0.9 °F) are associated with cold phase (La Niña) conditions. Oceanic Niño Index (ONI) is defined as the SST anomalies over Niño 3.4 averaged over the three months ending with the current month. If the ONI exhibits warm or cold phase conditions for at least five consecutive values, it typically becomes an El Niño or La Niña event.

El Niño has a significant impact on the global weather. The effects depend strongly on the location and the season. El

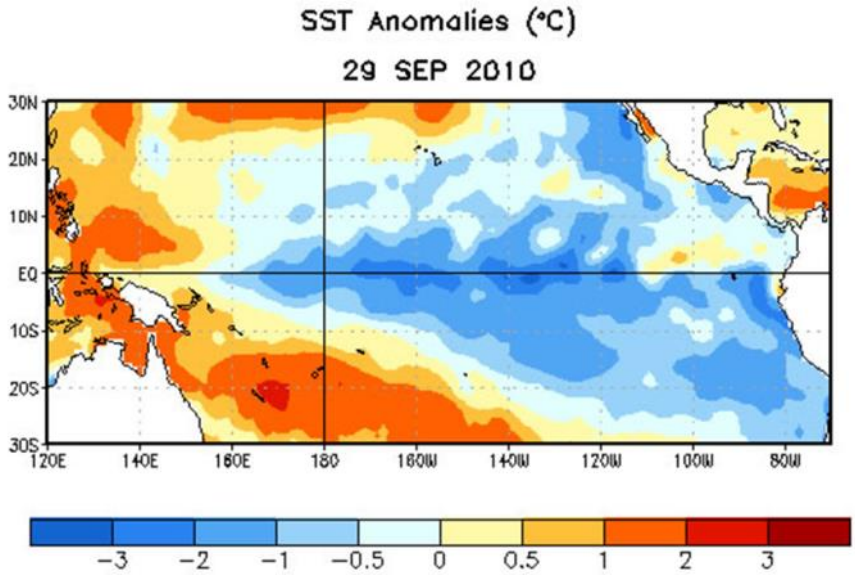

Fig. 2: SST pattern over the equatorial pacific during a La Niña event of the 2010 year. (Source: Climate Prediction Centre NOAA)

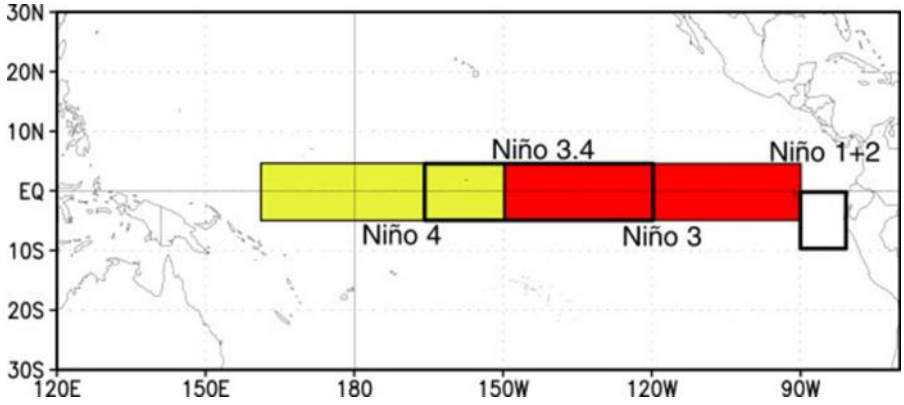

Fig. 3: Map illustrating Niño regions for deriving Niño Indices. (Source: Source: Climate Prediction Centre NOAA)

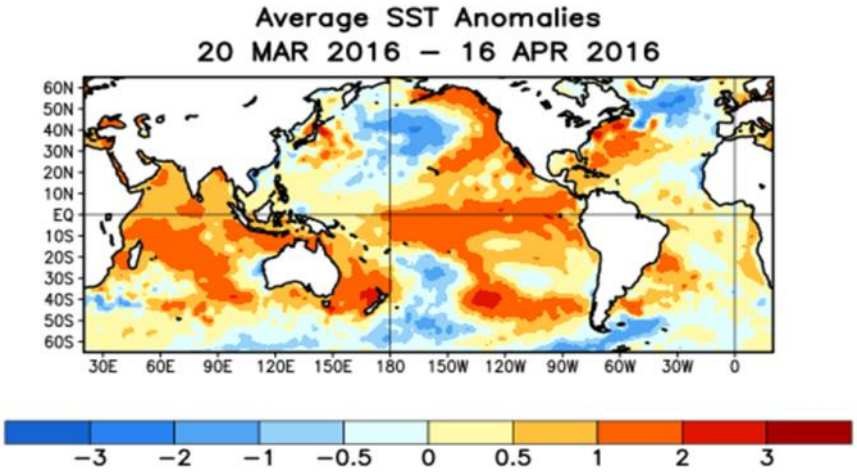

Fig. 4: Average SST anomaly during the period 20 March - 16 April 2016 depicting current El Niño state. (Source: Climate Prediction Centre NOAA)

Niño brings heavy rainfall to the South America whereas it brings drought to the South East Asia and Australian region. During an El Niño, when the SST anomaly shifts eastwards, droughts and wild fires occur in Indonesia and Australia while heavy rains, floods and landslides prevail in Peru.

In major parts of Southeast Asia, prolonged drought associated with the strong El Niño climate system in 1982-1983 and 1997-1998 brought widespread and uncontrollable forest fires, which led to severe transboundary haze. The longest and most severe episode in 1997 resulted in more than US$4 billion (RM12.87 billion) in economic losses across Southeast Asia, including Malaysia.

El Niño current state and forecast

The Climate Prediction Center of the US National Oceanic and Atmospheric Administration (NOAA) provides information on the strength and current scenarios regarding El Niño/ La Niña. Currently, a strong El Niño which commenced in May 2015 and peaked in January 2016 is weakening as reflected by its SST anomaly pattern over the central and eastern Pacific. It is expected to weaken to the ENSO-neutral condition during the Northern hemisphere summer (Mar-April 2016) (Fig. 4). It is likely to transform into a La Niña condition during the second half of the year (July-September 2016).

Based on Outgoing Long wave Radiation (OLR) anomalies in which negative/ positive anomaly indicates enhanced/ suppressed convection, convections in South east Asia and Australian region are shown to be suppressed with little or no precipitation. On the other hand, the South America and US region are having enhanced convection and precipitation. This is clearly depicted in spatially in figure 5 and temporally in figure 6.

Figure 5 clearly depicts the

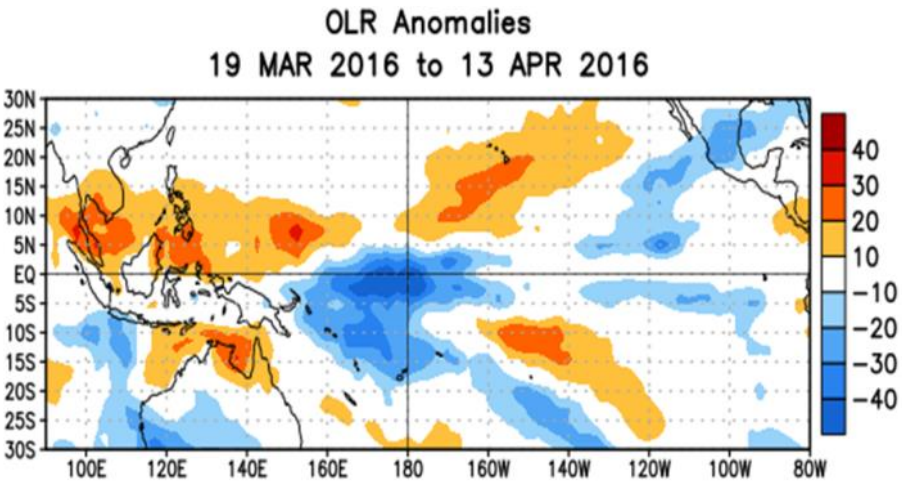

Fig. 5: OLR anomaly showing the enhanced/ suppressed convection areas resulting from the current strong El Niño. (Source: Climate Prediction Centre NOAA)

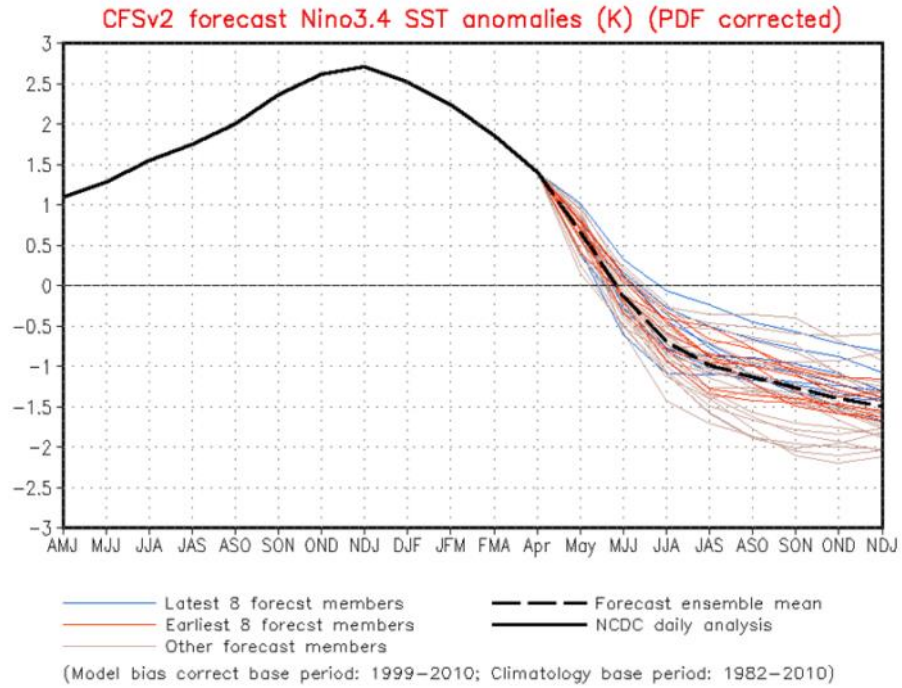

Fig. 7: The NCEP CFS.v2 ensemble mean forecast (black dashed line predicts Neutral during May-June-July (MJJ) and La Niña after June-July August (JJA) 2016. (Source: Climate Prediction Centre NOAA)

suppressed convection in terms of positive OLR anomalies particularly over the Peninsular Malaysia, implying dry and hot weather due to the effect of strong El Niño. Throughout the period, negative OLR anomalies have been observed over the central and/ or eastern Pacific, and positive anomalies have persisted near Indonesia.

The ensemble mean of NCEP CFS.v2 predicts that there is a 60% chance of El Niño phase changing to La Niña phase after June-July-August (JJA) 2016 (Fig. 7).

Summary

A strong El Niño was observed for 2015-2016 and at present it is weakening. It is predicted that it may transform into a La Niña phase after June-August 2016. This implies that for the South East Asia region, especially for the east coast of Peninsular Malaysia, there may be an

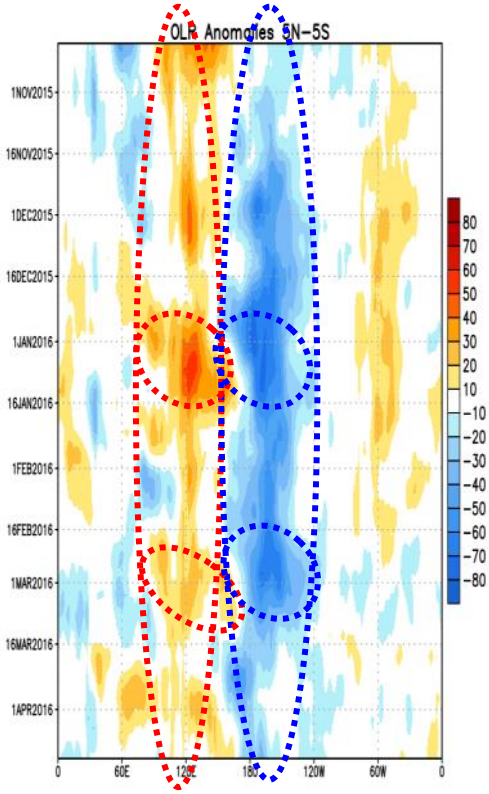

Fig. 6: Time –longitude Hovmoller diagram depicting enhanced/ suppressed convection cells in terms of negative/ positive OLR anomalies. (Source: Climate Prediction Centre NOAA)

enhancement of convection and therefore an increase in the rainfall. The chances of increase in rainfall indicate potential chances in flooding along the east coast of Peninsular Malaysia during the later part of the year.

Authors information:

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Biopolymer Electrolyte Based Dye-Sensitized Solar Cells (BioPE-DSSC)

Dye-sensitized solar cell (DSSC) is a low-cost solar cell that belongs to thin film solar cell groups. The DSSC is also known as Gratzel cell which invented by Brian Oregan and Michael Gratzel in 1991.

This solar cell is based on colloidal TiO_2 films. Each DSSC contains three major parts namely photo-anode electrode, counter electrode and electrolyte. Photo-anode electrode is a glass substrate with a conductive layer such as indium tin oxide (ITO) or fluorine doped tin oxide (FTO) which coated with TiO_2 paste and soaked in ruthenium based dye. Counter electrode is normally coated with platinum. The electrolyte is normally made from three types of materials, *i.e.* solid, gel and liquid type. The schematic view of a DSSC is demonstrated in figure 1.

Since the DSSC is consisting of combinations of several materials, the properties of each component directly influence the kinetics and reactions. Thus, device performance depends on the morphology, optical and electrical properties of the porous semiconductor film; the chemical, electrochemical, photophysical and photochemical properties of the dye; the electrochemical and optical properties of the redox couple and solvent in the electrolyte; and the electrochemical properties of the counter-electrode. The efficiency of a DSSC in the process for energy conversion depends on the relative energy levels and the kinetics of electron transfer processes at the sensitized semiconductor/electrolyte interface. As a consequence, the preparation of electrolyte is one of the major concerns to enhance the DSSC performance. Furthermore, the investigations on dye-sensitized solar cells (DSSCs) have been dramatically increased in recent decades due to low cost, easy fabrication and carbon free advantage of (DSSCs). Besides, one of the possible electrolytes to be introduced as an electrolyte in DSSC fabrication is polymer electrolyte.

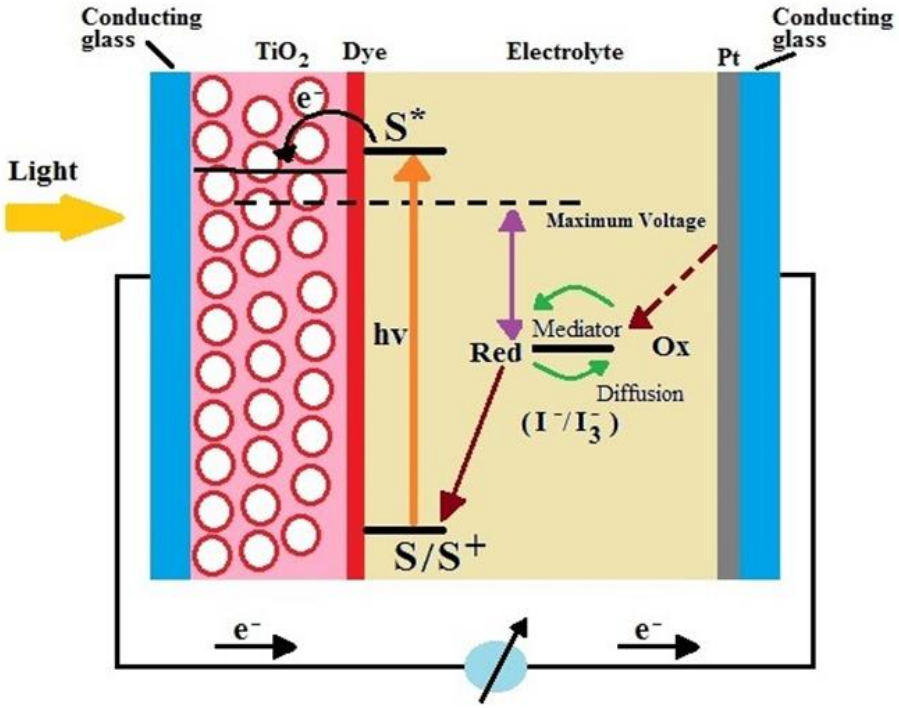

Fig. 1: Schematic view of dye-sensitized solar cell.

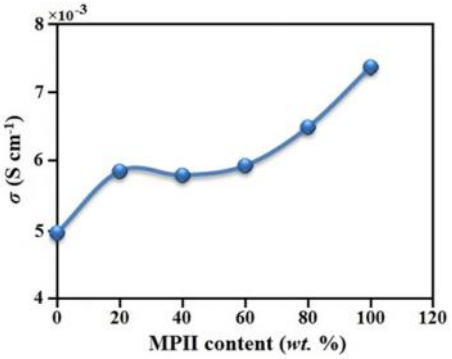

Fig. 2: Variation of Ionic conductivity with MPII ionic liquid content in HPC based system.

The polymer electrolytes are electrolytic materials that offer many advantages in the area of large, high energy density batteries for electric propulsion and in fuel cells for electric vehicle or solar cell applications. In polymer electrolytes, the mechanism of the interaction between polymer and salt can be explained with ion solvation by the poly-

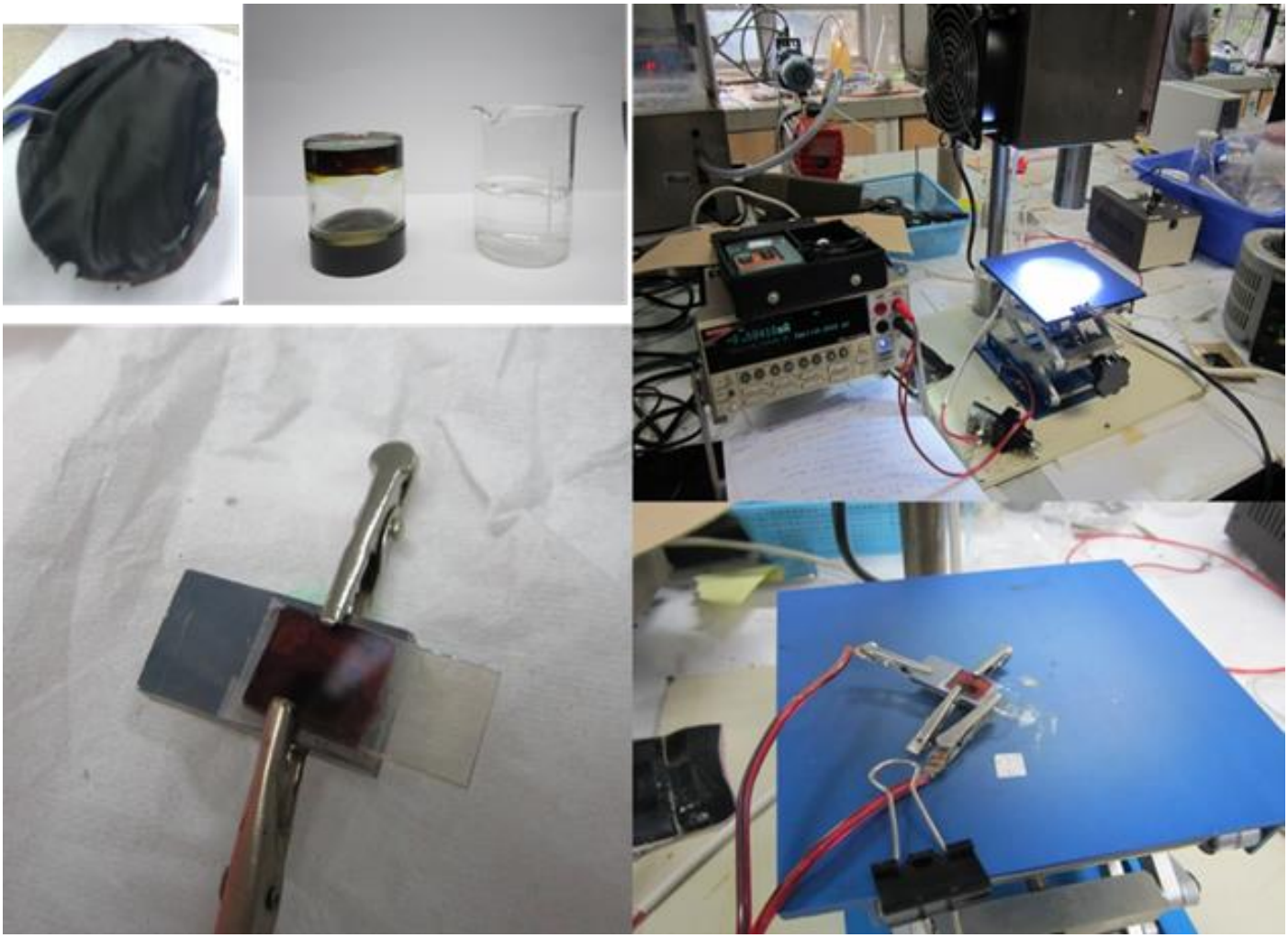

Fig. 3: Demonstration of polymer electrolyte samples with typical fabricated DSSC and testing under Sun simulator.

mer. Due to the presence of polar groups in polymers, it can be expected that they will behave as high-molecular-weight solvents and dissolve salts to make a stable ion-polymer complexes. A salt can only be dissolved in a solvent if the associated energy and entropy changes produce a general decrease in the free energy of the system. This emerges when the interaction between the ionic species and the coordinating groups on the polymer chain compensates for the loss of salt lattice energy.

Among synthetic based polymer electrolytes, biopolymer electrolytes have been investigated and drawn great attentions for dye-sensitized solar cell (DSSC) applications. In addition, due to some disadvantages of synthetic polymers such as being non-biodegradable, harmful, need chemical synthesis, synthesized by petroleum based materials, effects on "Climate Change", flammable and relatively high cost; biopolymers have become good candidates to solve the existing issues by synthetic polymers such as being biodegradable, abundance in nature, non-toxic, non-flammable, no chemical process is required, low cost and flexible. Moreover, this work is based on natural biopolymers as environmental friendly sources.

In this work, two biopolymers namely rice starch (RS) and hydroxypropyl cellulose (HPC) were used in different solid and gel type polymer electrolyte systems. Sodium iodide (NaI), and 1–methyl–3–propylimidazolium iodide (MPII) and 1-hexyl-3-methylimidazolium iodide (HMII) ionic liquid as imidazolium based ionic liquids (ILs) were used for polymer electrolyte preparation as well. Consequently, iodine (I_2) as redox mediator in DSSC was used. The preparation of polymer electrolytes was involved in some stirring, heating and cooling processes to get a polymer electrolyte with good mechanical property.

The polymer electrolytes were examined under electrochemical impedance spectroscopy

(EIS) for ionic conductivity and dielectric studies. The highest ionic conductivities of 1.83 and 7.37 $mScm^{-1}$ were achieved in rice starch and HPC based polymer electrolyte systems, respectively. The variation of ionic liquid with MPII ionic liquid in HPC based polymer electrolyte system as the highest achieved ionic conductivity is shown in figure 2. Temperature-dependent ionic conductivity studies indicated that the polymer electrolyte systems follow Arrhenius thermal activated model.

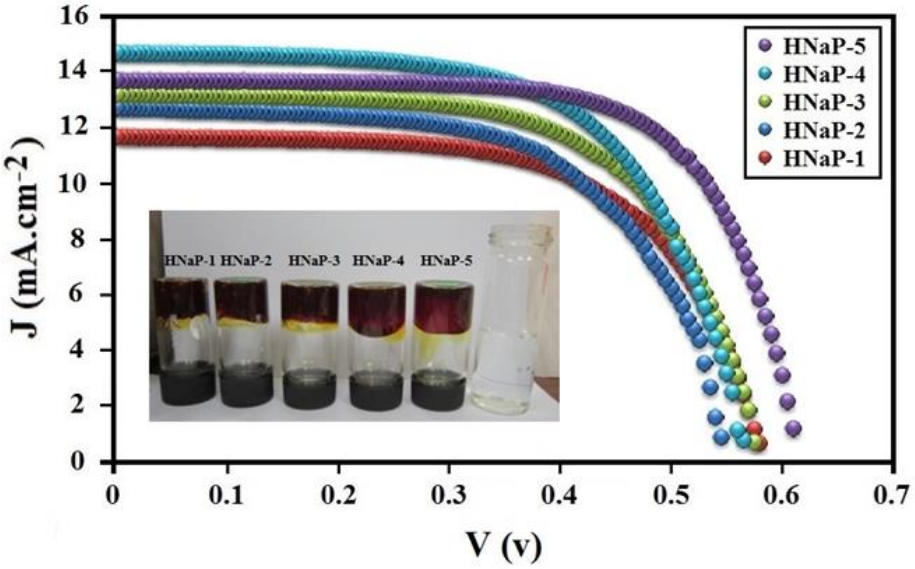

Fig. 4: J-V graphs for some HPC based gel polymer electrolytes.

The polymer electrolytes were studied for structural behaviors. The structural studies confirmed that the complexation between biopolymers, sodium iodide and ionic liquids has occurred. Double-layer TiO_2 paste was coated on FTO glass as photoactive electrode. Pt coated FTO glass was used as counter electrode. Photoactive electrode soaked in N719 dye for about 24 hour. The Polymer electrolytes were sandwiched between two anode and cathode electrodes for DSSC fabrication. The J-V characteristics of fabricated dye-sensitized solar cells were analyzed under Sun simulator. Figure 3 illustrates the procedure for preparation of polymer electrolyte and DSSC fabrication. The highest energy conversion efficiencies of 3.42% and 6.24% were achieved for rice starch and HPC based polymer electrolyte systems, respectively. Figure 4 exhibits the J-V results for HPC based gel polymer electrolytes with designations of HNaP-1, HNaP-2, HNaP-3, HNaP-4 and HNaP-5 for incorporation of 20, 40, 60, 80 and 100 wt.% of MPII ionic liquid, respectively. The biopolymer electrolyte based dye-sensitized solar cells can be used for many applications to provide environmentally friendly, low cost and economic solar cells for the society, and help to overcome "Climate Change" issue and reduce pollutants through decrease the chemical processes for production of synthetization of polymers.

Gold Medal & Best Award in MTE 2016

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Germanium Flat Fiber Dosimetry Kit

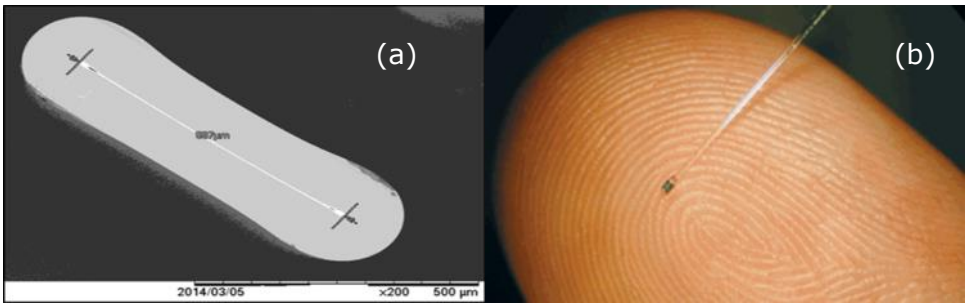

Fig. 1: (a) Scanning Electron Microscope (SEM) images from the cross-section of the flat fibre, and (b) enlarge image of flat fibre on a finger.

Germanium flat fiber (Ge-FF) (Fig. 1) has been proposed as a novel silicon-based radiation sensor, which is dependent on the thermoluminescence (TL) produced when irradiated. This fiber is designed and fabricated by a dosimetry research group funded by the University of Malaya High Impact Research (UMHIR) grant. The research group has long-standing strengths in performing cutting-edge scientific research in radiation sensor and photonics technology. The high quality of the Ge-FF material is the basis of an intelligent kit that provides a total dosimetry solution, representing an important aspect of a comprehensive personal radiation sensor. The Ge-FF sensor will benefit over 30,000 workers working in radiation environment in Malaysia, which including those working in nuclear-based facilities, and medical laboratories. The Ge-FF dosimetry kit can be used to monitor exposure to ionizing radiation in both real time and offline, emitting either a radioluminescent (RL) or thermoluminescent (TL) signal respectively, which allows the worker to react timely when the radiation dosage levels exceed the allowed dosage. Using the multi-detector technology coupled with an excellent response to electrons, gamma, beta, neutron, and x-ray-radiation, the Ge-FF kit can ensure safety in any environment. The TL glow curves produced can be analysed by Windows-based software and by such means the main TL dosimetrics properties have been determined using the deconvolved TL glow (Fig. 2) peaks. The developed FF sensitivity for ultra-high dosage radiations is enhanced by more than 4.8 times than that of the sensitivity of the older phosphor-based technology of TLD-100 (a popular technology world-wide). The FF sensitivity is highly dependent on the Ge-dopant concentration and irradiation dose. The overall results indicated that the Ge-FF can be used as a radiation sensor in high-dose dosimetry.

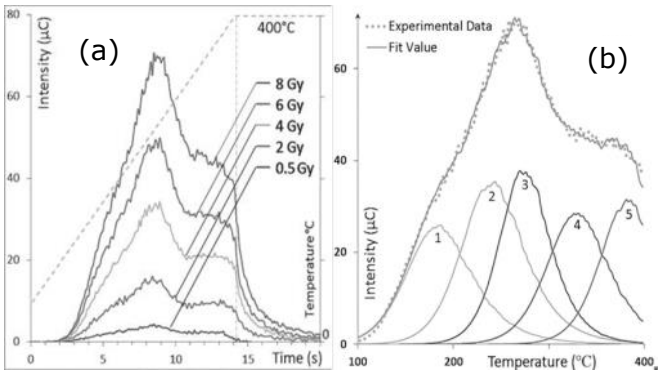

Fig. 2: (a) The glow curves obtained using five different doses (b) shows the results of glow curve deconvolution.

A general overview on the application of the Ge-FF is the tailor–made fibers, produced by the UMHIR in collaboration with the Multimedia University, using the modified chemical vapor deposition (MCVD) method. This MCVD process utilized vapor mixture of highly pure silica tetrachloride ($SiCl_4$) and germanium tetrachloride ($GeCl_4$) as starting material. The fibre-pulling facilities located at the Flat Fibre Laboratory, Department of Electrical Engineering, University of Malaya has resulted in the production of a family of fiber morphologies (cylindrical, flat-

and photonic crystal-fibres for example) (Fig. 3). These materials have been tested for sensitivity towards ionizing radiation detection, with energy response from several eV to 10 MeV. The fibres have been shown to have unsurpassed response towards radiation exposures, including that from UV, X-rays, gamma rays, alpha particles and neutrons, making this fibre materials the basis of an excellent multi-purpose radiation detector. Our work has additionally allowed us to understand the source of the light, i.e. luminescence, using a variety of sophisticated spectroscopies and to control the amount of light emitted from the exposure to radiation (Fig. 4). The present development has potential for application in: (i) measuring the actual amount of radiation used at the location of a tumour during radiotherapy; (ii) measuring radiation used in diagnostic x-ray clinics; (iii) measuring levels of radiation prevalent in the environment, and; (iv) measuring radiation levels in outer space from satellite based facilities.

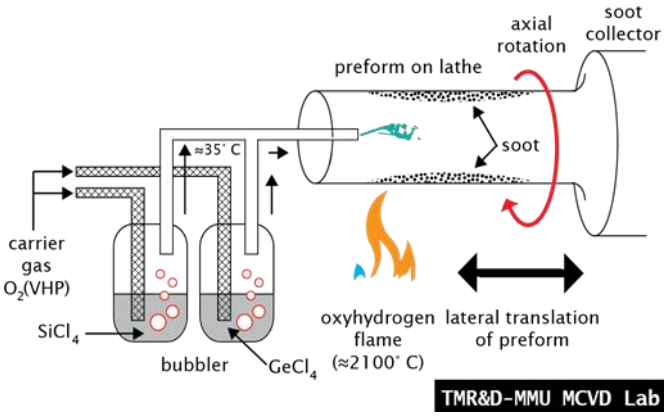

Fig. 3: (Top) Fabrication via MCVD process utilized $SiCl_4$ and $GeCl_4$; (Bottom) Fibre pulling tower located at the University of Malaya, Malaysia.

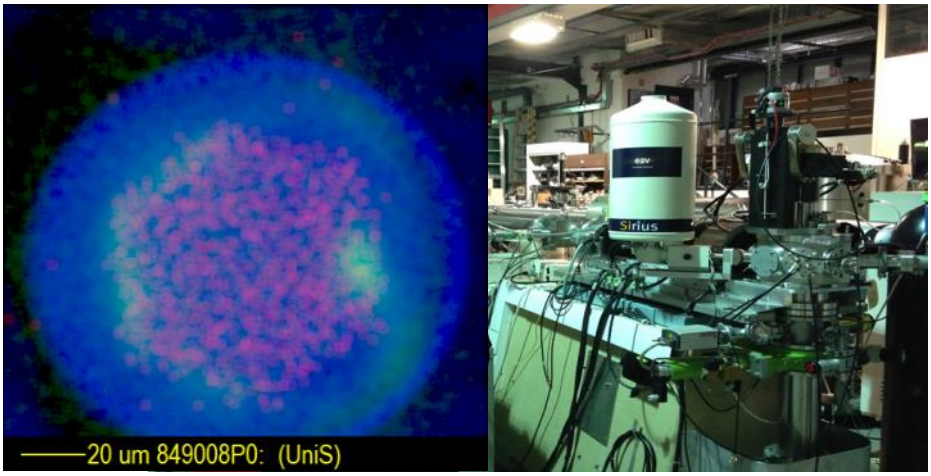

Fig. 4: The beamlines situated in the Surrey Ion Beam Centre showing the relative presence of the identified elements, Si (blue), and Ge (red) and light (green).

Gold Medal in MTE & ITEX 2016

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Innovation in Healthcare

OsteoKnee™

As humans reach old age, mobility will become an issue as the elderly faces problem with muscle strength and Osteoarthritis (OA). While muscle strength issue can be avoided by exercising the muscle, OA can only be overcome via surgery. Therefore, an early detection for OA can give a huge advantage to the elderly. OA has become the leading cause for disabilities in a few countries. According to the World Health Organization (WHO) worldwide estimates, 9.6% of men and 18.0% of women aged over 60 years old suffer from symptomatic OA. 80.0% of them will have limitations in movement and 25.0% of them are unable to perform their daily activities.

Currently, OA is diagnosed using imaging processes such as X-ray and Magnetic Resonance Imaging (MRI). These methods involve expensive hardware and manpower. Other methods such as Joint Fluid Analysis (JFA) and Arthroscopy are invasive, which are not the most ideal diagnostic methods.

OA does have some early symptom that can be observed, such as knee swelling and knee crepitus (cracking sound). Many patients develop knee swelling following knee injuries, or as a result of exacerbation of their knee osteoarthritis. The degree of swelling, and also the sound produced can be quantified and analyzed to obtain important information related to the conditions of the patient.

OsteoKnee™ is an early detection tool for osteoarthritis and it helps medical staff to observe, and monitor the condition of the symptom of OA in the patient. OsteoKnee™ functions in two modes, namely the pressure mode and the sound mode. At the present, the available methods to quantify knee swelling or intra-articular knee pressure is not easily accessible; can be invasive and expensive. The present bed-side method of checking for knee effusion is not reliable and lacks objectivity. By using the pressure mode of OsteoKnee™, the level of knee swelling can be quantified and thus, it aids the medical staff in monitoring the swelling symptom of OA. The sound of crepitus caused by OA has been studied by several researchers and it was found that the sound of crepitus of OA is generally in a specific frequency band and at certain amplitude. Thus, by using sound mode of OsteoKnee™ the sound of crepitus can be collected and further analyzed, which can be a great aid to physicians.

OsteoKnee™ has great potential to be commercialize because there is currently no diagnostic equipment available for OA assessment based on knee sound and knee pressure in the market. OsteoKnee™ is low cost, non-invasive, non-radioactive, and portable. OsteoKnee™ is a stand-alone point of care medical device, which can be easily obtained by clinics or even homes.

OsteoKnee™ features new choice of diagnosis method, uses minimal spatial apparatus and equipment, and is environmental friendly because it does not release harmful by-products.

OsteoKnee™ is targeted for the international market because OA is a worldwide problem. The market consists of medical service providers such as hospitals, clinics or even pharmacies, medical device manufacturers, researchers and academic sector such as schools and universities, and even families.

OsteoKnee™ research is led by Ir. Dr. Lai Khin Wee, Dr. Goh Siew Li (UMMC), Dr. Zulkarnain bin Jaafar (UMMC) along with team members: Jerry Choon Cheah Wee, Ong Zhi Hui, Yong Ching Wai and Victor Kean Shern Phng. Due to its novelty and high impact potential, OsteoKnee™ has achieved a brilliant track record in various competitions.

In early 2015, OsteoKnee™ achieved a great success in The Inclusive Innovation Challenge (IIC) 2015, jointly organized by the Ministry of Science, Technology and Innovation (MOSTI) and Yayasan Inovasi Malaysia (YIM). The team was the Champion and 2nd Runner-Up in IPTA/IPTS category. These awards were conferred onto the two predecessors of the OsteoKnee™, the "Syringe Knee Pressure Monitor" and the "Knee Sound Detector". Aside from the IIC 2015, the team was also awarded Gold Medals and Best of the Best Award in i-ENVEX 2015 organized by Universiti Malaysia Perlis.

OsteoKnee™ was also shortlisted in the i-CREATe Singapore which is an international platform of conference and exhibition featuring innovative technology, equipment, applications, techniques and materials applied in the field of Assistive & Rehabilitative Technology, where the team presented the latest prototype to the Guest of Honour, Her Royal Highness Princess Maha Chakri Sirindhorn of Thailand. Furthermore, OsteoKnee™ was awarded a bronze medal during PECIPTA 2015, gold medal award and INNOPA special award at the Malaysia Technology Expo 2016.

OsteoKnee™ has been shortlisted as one of the projects in the High Impact Programme 6 (HIP-6), a programme led by MOSTI. The team has received a lot of feedbacks and has made improvement on OsteoKnee™. Due to its novelty, the system has been successfully patented and OsteoKnee™ has been registered as a trademark. OsteoKnee™ has been featured in online news portals such as "The Petri Dish", "Medical Xpress", and "Asia Research News".

Gold Medal in MTE and ITEX 2016
The INNOPA Special Award 2016 (Indonesian Invention and Promotion Association)

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The NMR Spectroscopy in UM : A Personal Recollection

I had the pleasure and opportunity to introduce NMR spectroscopy to chemistry students beginning in the mid-1960s. But the Department did not have a NMR spectrometer until the early 1970s. It was a Perkin Elmer–Hitachi permanent magnet spectrometer for proton resonance at 60 MHz and fluorine-19 resonance at 56.4 MHz. It was a great achievement for the Department as it was the first NMR spectrometer installed in Southeast Asia and heralded great promise for research in chemistry at UM, although carbon-13 resonance was not yet feasible at this time. The same spectrometer was installed two years earlier at the University of Hong Kong. These were the only two NMR spectrometers existing in East Asia south of Japan in the early 1970s and were the envy of other countries in this region.

In the beginning was Continuous-Wave (CW). The NMR spectrometers that were made in the late 1950s to the mid-1970s operated in the CW mode; that is, the radiofrequency radiation was held at a constant frequency and the magnetic field was swept from low field to high field until all resonances were observed (detected) for a given sample. On the observed spectrum the magnetic field increased from left to right. That is, the right side of the spectrum corresponded to the resonance of a more shielded nucleus; the left side to a less shielded nucleus. Hence the right side of a NMR spectrum became to be associated with higher field and more shielding. This reference is often used even in the case of a spectrum obtained in a modern NMR spectrometer which operates in the pulse mode and in which the

magnetic field is held constant by a locking mechanism.

With the installation of this simple spectrometer, research activity picked up and many articles were published in reputable journals. In the 1970s foreign visitors to the department remarked that this Chemistry Department was the best in this region. Indeed UM was ranked higher than the University of Singapore at that time. It was fortunate that the permanent magnet spectrometer operated smoothly for many years without much maintenance. The magnet was thermostated at a fixed temperature and as long as the air-conditioning in the room was stable and with no frequent power disruptions, it functioned well. The electronics console was much simpler than the present day modern spectrometers and performed wonderfully. At times when it ceased to respond, the spectrometer was left idle for a day or two, and miraculously it would spring back to life. This was fortunate because there was no special allocation for the maintenance of this special instrument.

The department acquired in about 1980 a multinuclear Fourier Transform (FT) NMR spectrometer which was based on an electromagnet and gave proton resonance at 100 MHz. This spectrometer enabled carbon-13 and other nuclei to be observed. It added a new dimension to research in chemistry. However, it presented enormous problems in maintenance. The electromagnet generated much heat which was removed by a heat-exchanger (HX) placed outside the room. These two units had to function in tandem; when the HX failed, the magnet immediately tripped off. When that happened, it might take a day for the magnet to get back on -field after the HX was restored. For operation of the spectrometer, the HX had to operate continuously which was often interrupted by mechanical problems. Happiness was to see each morning the HX functioning smoothly in order to be able to use the spectrometer.

It was easy to say that all the problems associated with electromagnet spectrometers could be avoided in the case of superconducting magnets, besides generating higher magnetic. Maintenance of a superconducting magnet was easily in the order of RM50k for liquid helium and liquid nitrogen. At that time the university had no provision for such an expenditure. Should the magnet be quenched when either liquid went dry, it would cost RM250k to re-energise the magnet. These mandatory requirements prohibited any vision or dream of a superconducting NMR spectrometer at that time.

In the early 1990s the university acquired one superconducting FT NMR spectrometer for the *Institut Pengajian Tinggi* (IPT). Later another highfield NMR spectrometer was acquired by the Allied Materials Characterizing Laboratory (AMCAL) and this spectrometer was located in the Chemistry Department. Both these supercon magnet spectrometers are still functioning and in use. In subsequent years more supercon spectrometers were acquired in the university; to date there are eleven supercon spectrometers in the university, operating from 600 MHz to 270 MHz for proton resonance. This explosion in numbers of NMR spectrometers is testimony to the importance of the technique in chemical research for investigating structures and dynamics of molecules. It should also be mentioned here of the use of NMR in medicine for magnetic resonance imaging (MRI).

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Libguides

@ University of Malaya Library

As part of its strategic plan to provide a knowledge based service, the University of Malaya Library has implemented a new approach to assist users who are conducting research in a specific discipline or on a specific topic through Libguides. Libguides is a Content Management System used by many libraries worldwide to curate knowledge and share information by creating online guides on any topic, subject, course or any particular process. Springshare, the company providing the hosted system also provides for the servers, support, maintenance and free updates. The platform allows for easy navigation through and instruction on core and relevant resources in a particular subject field, class, or assignment.

The URL of libguides@University of Malaya Library is http://umlib.libguides.com/libraryguides and it is accessible 24 hours a day 7 days a week. Currently there are 15 subject guides from faculties such as Sciences, Dentistry, Medicine, Arts & Social Sciences, Language & Linguistics, Education and Performing Arts. The number of subjects are growing as liaison librarians from various clusters are assigned to develop online guides to bring together relevant information and learning resources, specific to a particular area of study.

The advantages of Libguides for students/ researchers are as follows :

- Provide researchers and students with 24/7 online assistance to library resources and information
- Offers resource customization for students. A student researching Geology can easily find the tools available for research under that discipline in Libguides
- All guides can be easily printed and thus serve as a handout at the same time
- Libguides serve as a one stop access for research information. Locate resources and find out which librarian to contact for additional information.
- Enable multiple Web 2.0 tools such as Youtube, RSS feeds, Facebook, Twitter, Wikis and blog which can be embedded into Libguides.

In general, most of the guides will feature major links to library resources such as Pendeta Discovery, Research Repository, Library website and to the interaktif Portal.

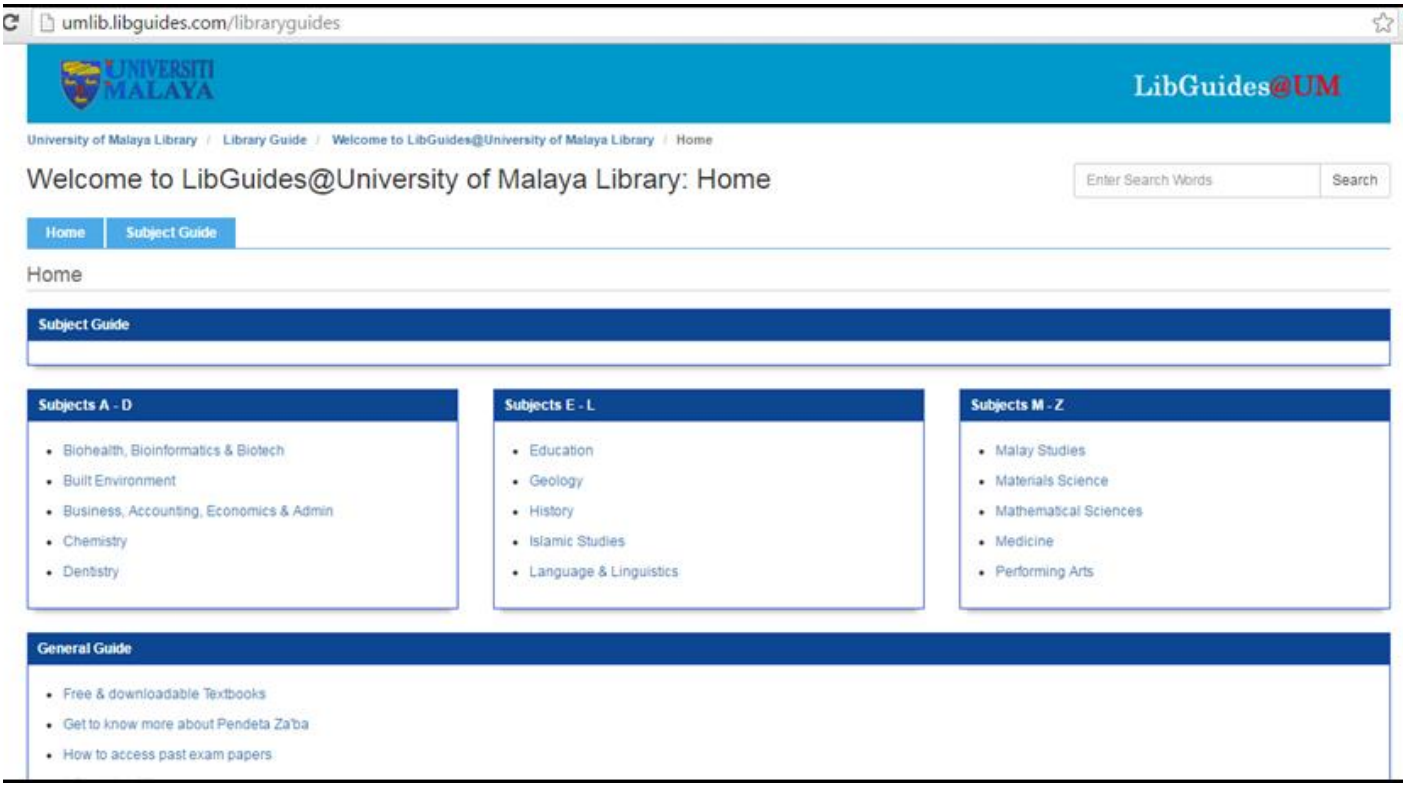
Selected e-journals, e-books, web resources and newspaper online that are relevant to the subjects are also provided. Users have variety sources of information from collections that have been highlighted by the librarians.

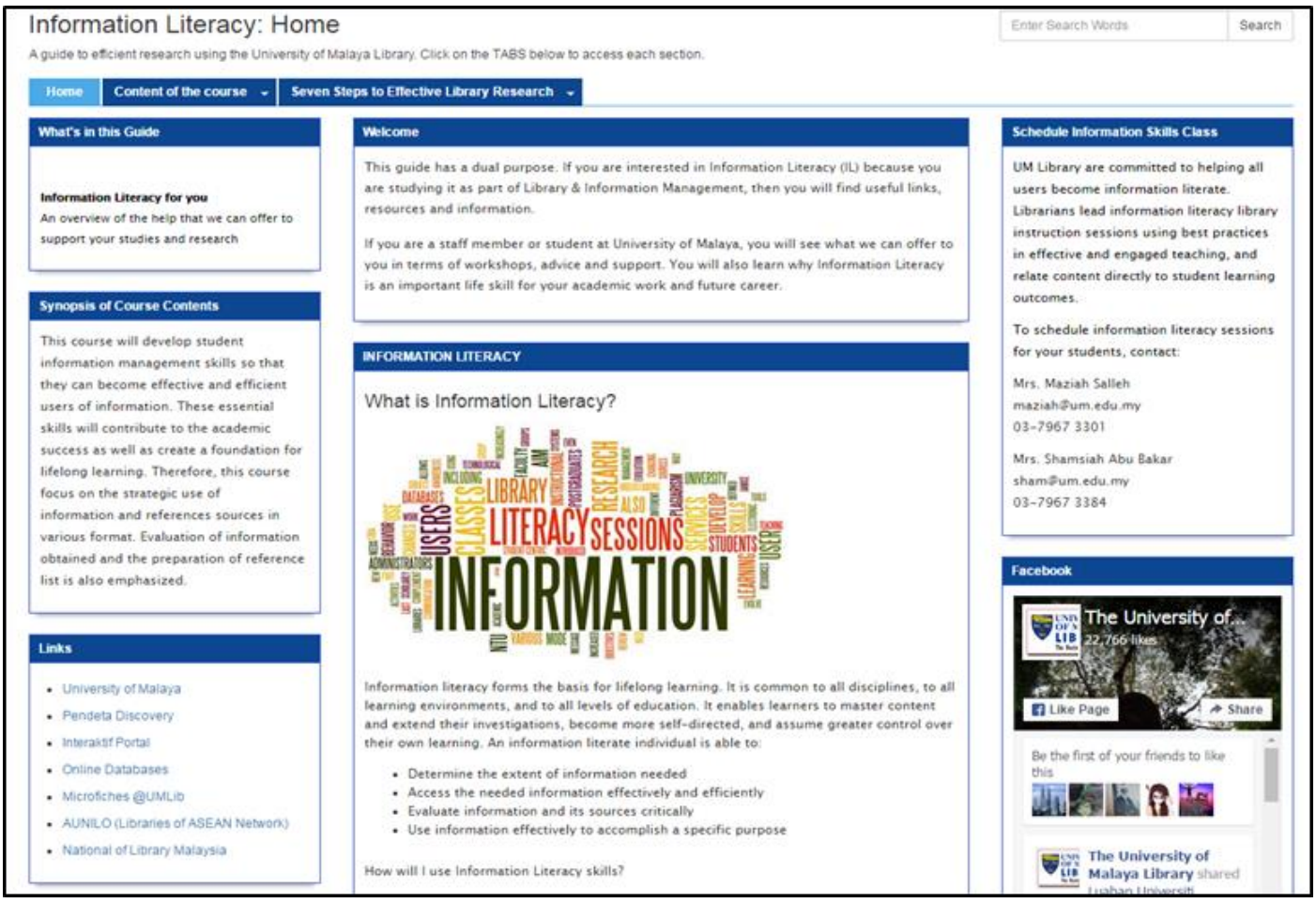
LibGuides also gives librarians the ability to deliver information literacy support and independent learning opportunities for users using Web 2.0 technologies all through a web browser. Studies have shown that LibGuides are able to provide online instruction content effectively and achieve learning objectives almost equally well as any other online platform. As such, a site for Information Literacy is then set up to cater for this need.

Besides meeting the needs as subject guides, LibGuides can be set up to provide target collection of links such as article databases, websites, suggested books and ebooks, newspapers, magazines on the same topic. It is a quick way to find reliable information in different formats, all relating to a chosen topic. Similar to Subject Guide, each Topic Guide contains tabs with information and links to useful resources.

There is still plenty of work to be done by librarians at this point of time. Libguides have the potential to be an important research tool and many studies have shown that students recognize that potential. It would be an ongoing challenge for librarians to rise to students expectations and continually evaluate ways to improve these resources and enhances the users' experiences.

How to access Libguides





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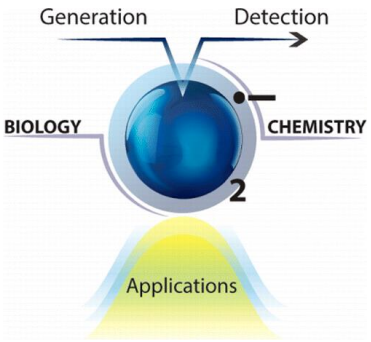
High Impact Publication in CHEMICAL REVIEWS: Superoxide Ions



The University of Malaya has recently become the first Malaysian University to produce a paper in the most well-known and universally acclaimed monthly based journal "Chemical Reviews", under the American Chemical Society publisher's umbrella. The importance of this journal reposes on its broad coverage of essential chemical topics; and its authority is derived from its impact factor of 46.568, coupled to the long list of high standing scientists with publications herein.

Two scientists from UM, namely, Prof. Dr. Mohd Ali Hashim, Head of the UM Centre for Ionic Liquids and Dr. Maan Hayyan, senior lecturer at the Civil Engineering department assume the co-authorship alongside Associate Prof. Inas Al-Nashef of the Chemical and Environmental Engineering department at the Masdar Institute of Science and Technology are the authors of this review article.

The focus of the review paper is the superoxide ion. Due to its significant role in diverse natural processes, O_2 importance has been thoroughly characterized. However, very few recognize the importance of oxygen in its other oxidative states, one of which is the superoxide ion O_2^- form. Biologically-speaking, O_2^- is a by-product of respiration and a crucial component of the immune defense system. Although O_2^- is often deployed by the immune system against invading pathogens, its synthesis is kept within limits because of its highly toxic attributes. With enough evidence linking it to cancer, and DNA damage, it's not surprising that O_2^- synthesis is internally monitored by superoxide dismutase enzyme (SOD). However, O_2^- research is not proactive; owing to its instability, reactivity and short half-life. Hereby, the potential use of O_2^- in industrial processes such as, electrochemical energy conversion, or material dissolution among others, require suitable preparation techniques.

Preparation methods usually vary according to the field and the targeted applications. Biology-based research often make use of pulse radiolysis to provide a well-defined solution and high O_2^- concentrations in the presence of specific radical-scavenging substances. It is widely used to study the reaction mechanisms of O_2^- with SODs and superoxide reductases enzymes. However, specialized equipment is required, and because O_2^- is a short-lived species in aqueous solutions, it decomposes almost immediately. Therefore, in terms of industrial applications, other generation methods such as, chemical and electrochemical methods, photochemical and photocatalytic methods and generation at oxide surfaces are employed.

The electrochemical generation of O_2^- entails the reduction of O_2 using an electrolyte with low viscosity, and high O_2 solubility. The short half-life of O_2^- promotes its generation in aprotic media. In contrast, O_2^- is highly reactive and spontaneously disproportionate in protic solvents. Electrochemical preparation is dubbed as the most convenient method, because no by-products are formed, although high purity O_2 and lots of energy are needed. The procedure is however relatively simple, time-efficient, and can be used to study O_2^- reaction kinetics.

The two-step chemical generation of O_2^- is simple and requires little energy. In the initial

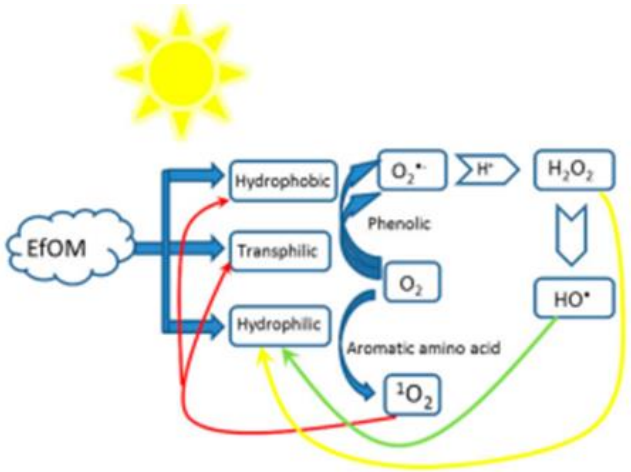


Fig. 1: Formation of reactive oxygen species from effluent organic matter .

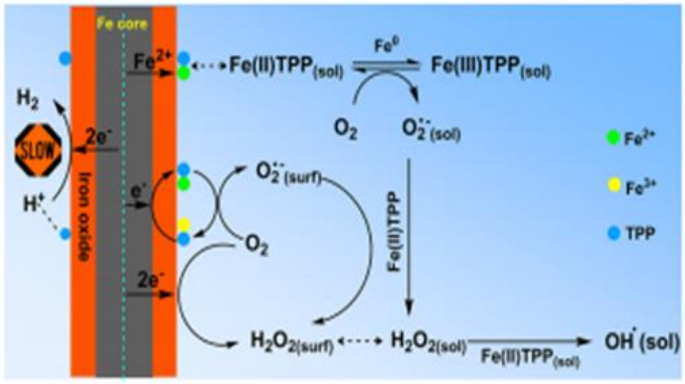


Fig. 2: Enhanced molecular oxygen activation with $Fe@Fe_2O_3$ nanowires in the presence of tetrapolyphosphate.

step, superoxide salts are synthesized using alkali metals which react with O_2^- at atmospheric pressure. Secondly, the superoxide ion is generated by dissolving superoxide salts in aprotic solvents.

Photochemical generation of O_2^- can also be used to investigate the effect of O_2^- particularly in the context of aquatic ecosystems and biotherapy. O_2^- in naturally sunlit surface waters, can be photochemically initiated by electron transfer from excited effluent organic matter (efOM) and metals to oxygen (Fig. 1). The resulting superoxide generally possesses long-term stability and can be stored at low temperatures.

The generation of stable O_2^- on oxide surfaces via photo-induced electron transfer, using catalysts such as $Fe@Fe_2O_3$ nanowires with inorganic ligands like tetrapolyphosphate (TPP) is also possible (Fig. 2).

The authors made it a point to distinguish ionic liquids (ILs) from the horde of aprotic and protic solvents. Accordingly, the limitations encountered using aprotic/protic solvents during superoxide preparation can be overcome using suitable ILs. ILs' wide electrochemical window, high stability, and non-volatility, sets them as highly promising media in various fields. As such, further in-depth research is required.

The authors also included a discussion of the current industrial applications of O_2^-. The applications of O_2^- technologies towards a safer and more efficient alternative for the destruction of hazardous halogenated hydrocarbons are entertained. The potential of O_2^- in converting sulfur compounds via the decontamination of structures is debated. The potential use of O_2^- for the remediation of contaminated soil and groundwater is also discussed.

The authors conclude the paper by discussing O_2^- detection methods. The privileged seat occupied by O_2^- in both chemical and biological work repose on their swift detection depending on the issue at hand. For instance, following synthesis according to any of the above methods (photochemical, electrochemical, etc.), detection of the final product in aprotic/protic/ILs media is crucial. The detection methods presented below can be classified into spectrophotometric and non-spectrophotometric methods. The main criteria for detection are often based on redox properties, electron spin resonance and trapping, the immobilization of certain enzymes on electrodes to act as biosensors for O_2^- detection, or pH measurement.

Overall, the authors sought to link O_2^- to both biology and chemistry fields. The emphasis being that although O_2^- has a key role in biological systems, its detection methods and mechanisms are still not well understood for a proper identification of the cause of many diseases and their potential treatment. A thorough understanding of O_2^- chemistry is therefore needed to help fulfill the demands of the twenty-first century.

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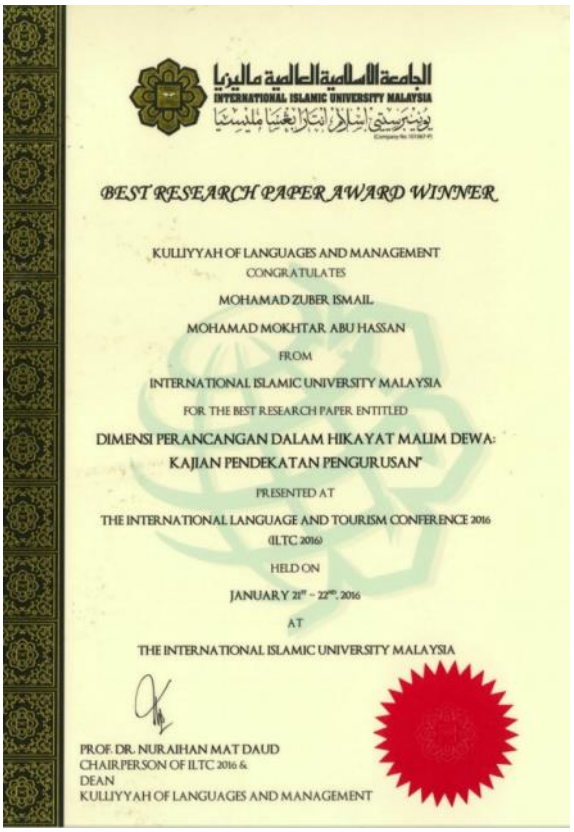
BEST RESEARCH PAPER AWARD WINNER

INTERNATIONAL LANGUAGE AND TOURISM CONFERENCE 2016 (ILTC 2016)

An International Language and Tourism Conference 2016 (ILTC 2016) was held on 21-22 January 2016 in Kulliyyah of Language and Management, International Islamic University Malaysia. This conference was organized by IIUM in collaboration with Prince of Songkla University (PSU), Trang Campus, Thailand; Sultan Agung Islamic University (UNISSULA), Indonesia; Vincent Pol University in Lublin, Poland and Malaysian e-learning council for Public Universities (MEiPTA).

A total of 108 research papers was presented in this conference from countries such as Thailand, Nigeria, Germany, Indonesia, Japan, Palestine, South Korea, United Kingdom, Philippines, India, Oman, Kazakhstan and Malaysia. A research paper entitled *Dimensi Perancangan Dalam Hikayat Malim Dewa : Kajian Pendekatan Pengurusan* from Professor Dr. Mohamad Mokhtar Abu Hassan, the Director of Academy of Malay Studies, University of Malaya and co-authored with his Ph.D. student, Mr. Mohamad Zuber Ismail was awarded as the best research paper in this conference.

This paper discussed about a new approach in cross disciplinary research between the literature study and modern management studies focusing on old Malay folk story, *Hikayat Malim Dewa*. The discussion based on planning principle (one of the principles in Management Approach in study literature) was introduced by Professor Dr. Mohamad Mokhtar Abu Hassan in a seminar held in the University of Sultan Idris, Perak in 2013. The analysis shows that principal of planning in *Hikayat Malim Dewa* is significant to describe leaders' plan to achieve the objectives of the organization. This research shows that principal of planning is one of the important indicators to prove the leaders' intelligence. This is a big success and great honor to the Academy of Malay Studies, University Malaya and congratulations to Professor Dr. Mohamad Mokhtar Abu Hassan and Mr Mohamad Zuber Ismail.



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ANUGERAH PEMENANG TERBAIK PENYELIDIKAN KERTAS KERJA

PERSIDANGAN BAHASA ANTARABANGSA DAN PELANCONGAN 2016 (ILCT 2016)

Persidangan Bahasa Antarabangsa dan Pelancongan bertempat di Kuliah Bahasa dan Pengurusan, Universiti Islam Antarabangsa Malaysia (UIAM) telah diadakan pada 21 – 22 Januari 2016. Persidangan yang bertemakan Roles of Research in Language and Tourism in Turning Insights Into Actions ini telah dianjurkan oleh UIAM dengan kerjasama Prince of Songkla University (PSU), Trang Campus, Thailand, Sultan Agung Islamic University (UNISSULA), Indonesia, Vincent Pol University di Lublin, Poland dan Majlis E-pembelajaran di IPTA Malaysia (MEiPTA).

Persidangan ini menerima sebanyak 108 makalah dari penyelidik tempatan dan antarabangsa antaranya dari Thailand, Nigeria, German, Indonesia, Jepun, Palestine, Korea Selatan, United Kingdom, Filipina, India, Oman, Kazakhastan dan Malaysia. Lebih membanggakan apabila kertas kerja penyelidikan bertajuk "Dimensi Perancangan Dalam Hikayat Malim Dewa : Kajian Pendekatan Pengurusan" yang ditulis oleh Pengarah Akademi Pengajian Melayu, Universiti Malaya, YBhg. Profesor Dr. Mohamad Mokhtar Abu Hassan bersama dengan calon Phd penyeliaannya, Encik Mohamad Zuber Ismail telah dipilih sebagai kertas penyelidikan terbaik untuk persidangan pada kali ini.

Kertas kerja tersebut mengemukakan pandangan baru dalam dunia kajian kesusasteraan Melayu yang merentas disiplin dengan ilmu pengurusan moden yang terdapat didalam cerita lipur lara Melayu, iaitu Hikayat Malim Dewa. Perbincangan berdasarkan prinsip perancangan, salah satu prinsip dalam Pendekatan Pengurusan dalam meneliti karya sastera yang diperkenalkan oleh Profesor Dr. Mohamad Mokhtar Abu Hassan di seminar yang diadakan di Universiti Pendidikan Sultan Idris, Perak pada tahun 2013. Hasil analisis memperlihatkan prinsip perancangan dalam hikayat Malim Dewa adalah signifikan dalam menggambarkan perancangan pemimpin yang meneraju negara demi merealisasikan objektif yang disasarkan. Kajian ini membuktikan bahawa prinsip perancangan merupakan salah satu indikator yang penting dalam mengangkat kebijaksanaan pemikiran pemimpin. Ini satu kejayaan yang amat membanggakan kepada Akademi Pengajian Melayu, Universiti Malaya dan tahniah kepada YBhg. Profesor Dr. Mohamad Mokhtar Abu Hassan dan Encik Mohamad Zuber Ismail.

Pemenang Anugerah ILTC 2016

Portable Modular Electrical Discharge Machine (PMEDM) for Micro Application

Manufacturing is very crucial to our country as it helps to improve the economy growth by generating productivity, stimulating research and development. The enhancement of technology and coupled with an increasingly specific market demand, has forced the manufacturing activities to move forward.

Advanced manufacturing involves the use of advanced, innovative, and cutting edge technology to improve products and processes. Understanding of a complex phenomenon in an easier form is very important for effective learning process. Today, facilitated knowledge will accelerate the proliferation of knowledge. Based on this particular problem statement, there is a need for the manufacturing sector to seek for a portable, simple yet powerful machining technology. Therefore, knowledge of advanced manufacturing processes, in particular in the form of Electric discharge machining (EDM) will give an advantage to users especially the engineering students. Innovation for EDM machine fabrication is to make it portable, modular, which explains the basic theory of EDM with the cheapest fabrication cost.

In order to tackle this problem, a portable modular electrical discharge machine (PMEDM) which resembles a conventional EDM in a simpler manner was proposed. EDM has been well known for its capability to conduct macro and micro machining applications on various kinds of material regardless of the hardness of the material. A very complex shape can be achieved using EDM in addition to having a good finished surface. EDM machining, also referred to as spark machining, is an advanced manufacturing process whereby a desired shape is obtained using electrical discharges sparks. Material particles are removed from the workpiece by recurring current discharges between tool electrode and electro-conductive

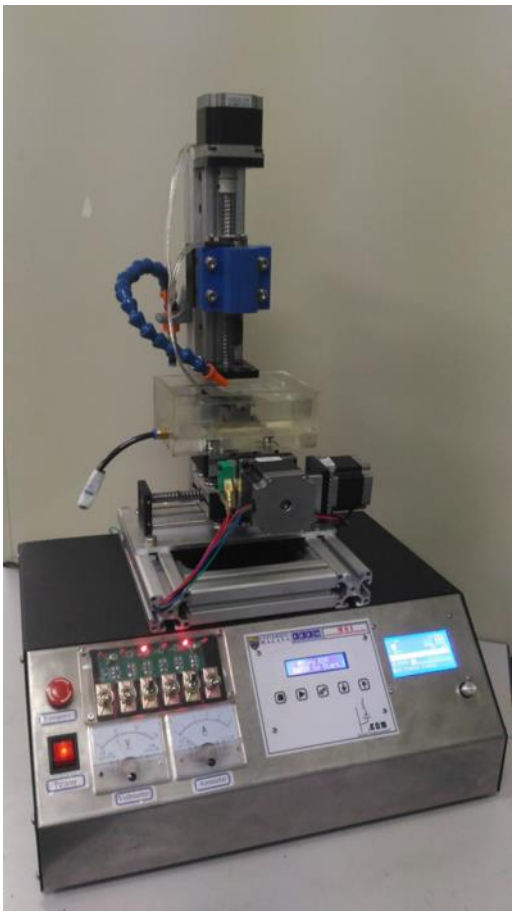

Fig. 1: Portable Modular Electrical Discharge Machine.

work-piece. Over the years, incremental improvements have been made on the machining performance from time to time. These incremental improvements have led to a state of the art EDM machines with the following advantages:

- not limited by the hardness of the work-piece, as long as the work-piece is electro-conductive;
- accurate and with a high degree of stability in relation to hole drilling processes;
- no part distortion, since no vibration is applied to the work-piece; and
- no heat distortion due to liquid cooling.

The advantages of EDM over conventional machining techniques, particularly in relation to the machining of electrically conductive work-pieces, have also led to the development of

PMEDM. The main distinguished feature between PMEDM and conventional EDM is the dimension of the plasma channel radius that resulted from the localizing sparking. In conventional EDM, the plasma channel radius is smaller by at least one order of magnitude than that of the electrode. In the case of PMEDM, the radius of the plasma channel and the electrode is roughly of the same size. Despite the advantages stated above, the EDM machines have limitation of being bulky and expensive and furthermore, they cannot be relocated easily to a remote job site. EDM machining for the most part, still utilizes standard tool-room which include fixturing and bulky work-pieces. This results in an expensive, over dimensioned machine tool though capable of handling heavy electrodes, not necessarily able to respond correctly to small electrodes, and also inefficient use of energy expended to run the relatively large servo systems.

In view of the above, it would be advantageous to have a portable EDM machine for effecting micro electrical discharge machining at a remote work-site. EDM machines available in the market are very expensive and bulky; it is less suitable for learning the basic process. Among the aspects to be considered in the fabrication process of EDM machine is the concept of 'Seeing is believing', where students can see how the EDM sparking occur during machining process. EDM machines are built with two main components, *i.e.* the mechanical and the control unit. Mechanical structures including base structure XY table, Z-axis motion, tank, tool holder, workpiece holder. The controller unit consists of EDM discharge power, XY motion controller and Sparking motion controller. Figure 1 and 2 show the complete unit of PMEDM machine and some outputs.

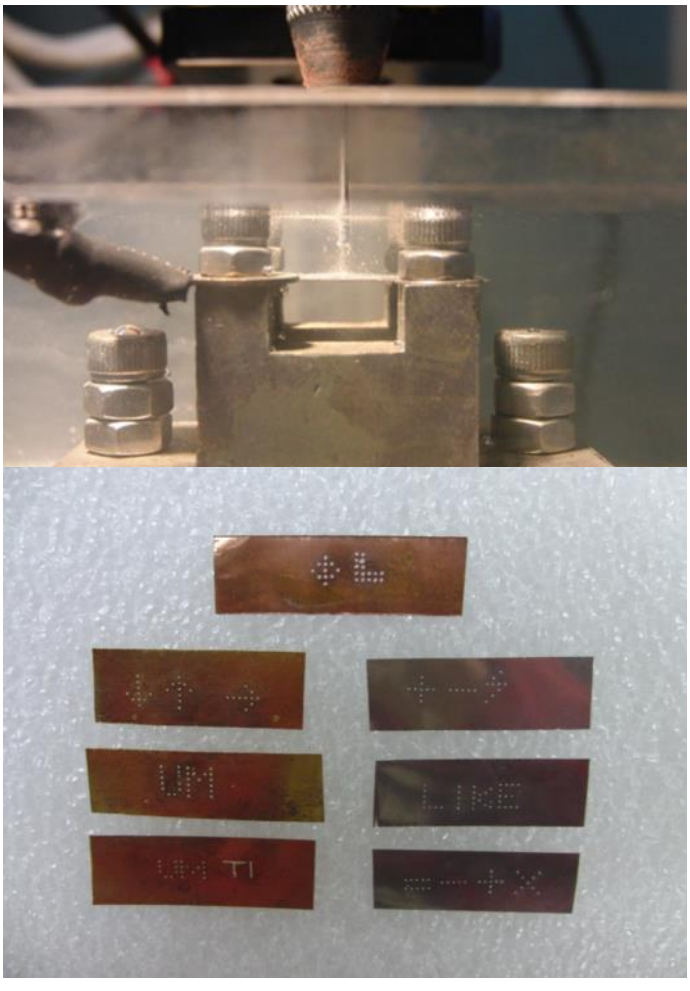

Fig. 2: PMEDM in action (top) and the products (bottom).

Among the advantages of developed PMEDM machine are:

- Simple structure
- Easy to operate
- User-friendly table control
- Capacitors are exchangeable
- Easy portability
- Suitable for research

In brief, the PMEDM will assist students in understanding the EDM machining process better. Also, it can help researchers to carry out investigations on electrical discharge machining at the micro level.

Gold Medal in MTE & ITEX 2016

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Smart Outdoor Lighting System

Malaysia Technology Expo (MTE) is an annual programme organized and endorsed by the Malaysian Association of Research Scientists (MARS) since 2001. The event displayed more than 500 exhibits of platform inventions and innovations to a targeted audience of trade visitors, connecting inventors and innovations to investors, manufacturers and distributors to aid commercialization. MTE 2016 was held on 18-20 February 2016 at Putra World Trade Centre. The event was officiated by YB Datuk Seri Panglima Madius Tangau, Minister of Science, Technology and Environment Malaysia. A project entitled "Smart Outdoor Lighting System with Emergency Beacon, Flood Warning Transmission System and Security Camera" from Faculty of Engineering, University of Malaya won the silver medal in the exhibition.

The team led by Associate Professor Dr. Chong Wen Tong from the Department of Mechanical Engineering, presented an innovative design of a self-sustained hybrid outdoor lighting & charging system with mosquito trap and flood emergency warning transmission system. The system comprises of the omni-direction-guide-vane (ODGV) integrated with vertical axis wind turbine (VAWT), solar photovoltaic panel, mosquito trap, buoy and laser distance sensor to measure the depth of water and send emergency signal. This system is green, independent and powered by solar and wind energy. The power generated is higher compared to the other similar products attributing to the novel ODGV and orientation of solar panel mounting. During flood, the electricity supply has to be cut-off for safety reasons. Under this circumstance, the product is able to generate sufficient energy to light-up the surrounding area by complimenting the energy from wind and solar. The battery/storage, wiring system and controller are placed near the top portion, so that it can still function even the flood level raises to about four meter (depending on the pole height). A sensor can be integrated and installed inside the hollow pole (to prevent vandalism) to sense the flood water level and transmit warning signal to search-and-rescue centres. The excess power can also be used to power the mosquito trap that can be integrated to the pole.

Four units of the system with various design variants are installed in UM main campus, three units at the UM off-campus research centre at Ulu Gombak and one unit is installed at the DBKL bicycle track near Mid Valley Mall. These units serve as the pilot tests and design improvement is conducted continuously. The team is currently working with the commercial partner, Ming Agri International Sdn. Bhd. to market the product.

Silver Medal in MTE 2016

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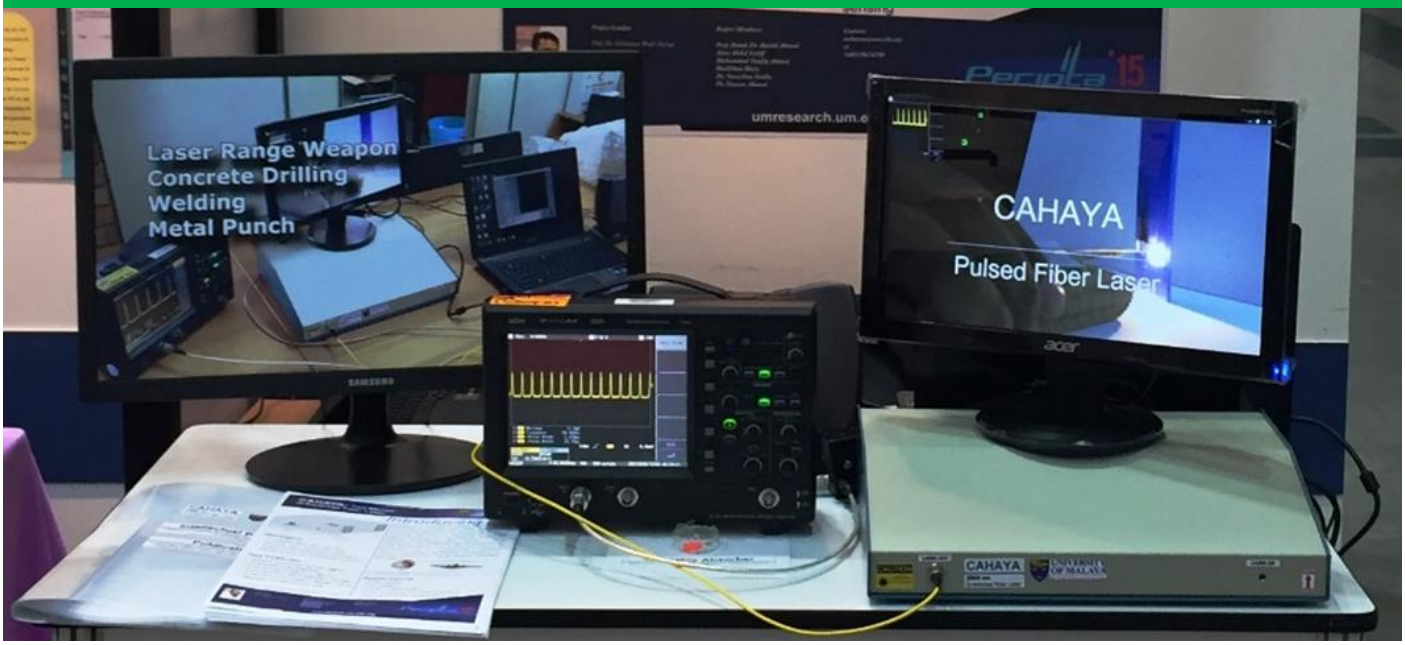
CAHAYA:
2-Micron Q-switched Fiber Laser



In material processing industry, conventional laser cutting and marking for plastic materials application, additional chemical additives were used to increase laser light absorption at the cutting area. Consequently, these additives make manufacturing process more difficult and not compatible for medical application usage. CAHAYA is a solution to this problem.

Plastic materials can be cut and marked immediately without additional chemical additives. Due to the potential demands in cutting applications industry, a group of engineer and scientist from UM has invented an advance pulsed fibre laser module, CAHAYA. CAHAYA in Malay language means light. It can deliver true pulsed fibre laser and easily to be operated by PC or handheld computer.

In contrast to commercially available lasers such as gas laser or dye laser, CAHAYA is an all -fibre laser technology. The fiber laser is more robust, compact in size, alignment-free, nearly zero maintenance, and cost-effective. Passive saturable absorber is a key to self-pulsing in fiber laser. The saturable absorber is fabricated from the nanomaterial elements. The fabricated saturable absorber is inserted between the two fibre connectors in the ring cavity (Fig. 1). Thulium-doped fiber as a gain medium is responsible to generate laser at 2-micron region. CAHAYA generates Q-switched pulsed laser with repetition rate in kilohertz, pulse duration in micro seconds, and high peak power. Extra external protective wear such as safety goggle is not required during the laser operation as the laser is "eye-safe".

Details about this research work is available in The Journal of Engineering (Doi: 10.1049/joe.2014.0038). To date, CAHAYA has been awarded a bronze and a silver medals at PECIPTA 2015 and MTE 2016 exhibitions, respectively (Fig, 2 and 3). The researchers are currently expanding the laser module as a neutralizer for land and air threats in advanced application. This work is a join collaboration between Prof. Dr. Sulaiman Wadi Harun and AVP Engineering (M) Sdn Bhd.

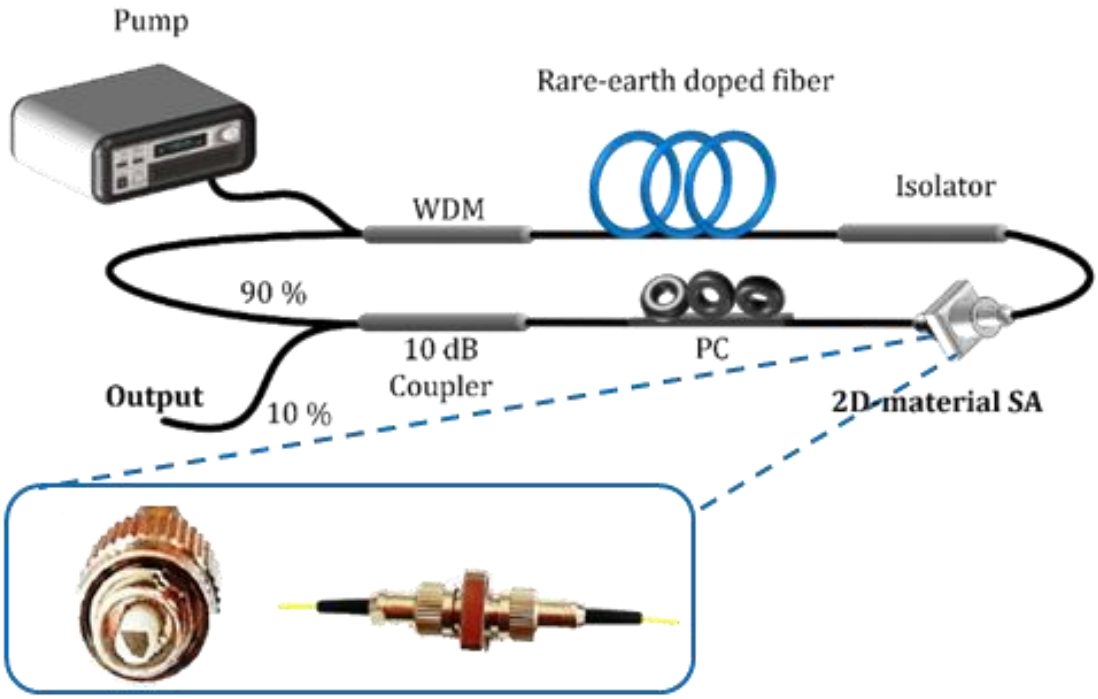


Fig. 1: Pulsed fiber laser configuration in ring cavity. Inset image shows the position of saturable absorber.

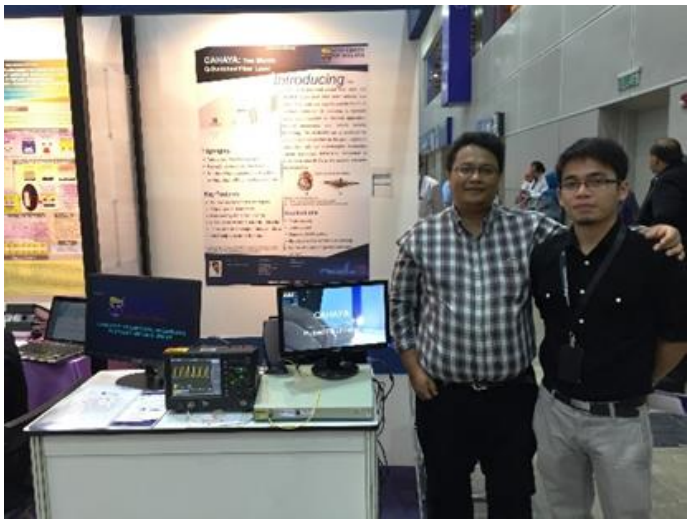


Fig. 2: Prof. Dr. Sulaiman and co-researcher at PECIPTA 2015.

Fig. 3: Team members at MTE 2016.

Silver Medal in MTE 2016

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mySMART Leg

Amputation through the leg bone above the knee results in lost of the knee joint and it is called transfemoral leg amputation. Patients who lost their leg above the knee would find it hard to perform most of the normal leg function like walking, running, sitting, standing, especially climbing and going down staircases. This is because knees are the most useful joint to perform activities. Normally, people who are amputated above the knee with a prosthetic leg would allow them to stand without walking aid and walk around to perform their daily activities. The prosthetic legs they get may either be very basic, *i.e.* only allows basic movements or embedded with intelligent processing to make the movements smoother and less energy required. Amputees usually have to practice walking using their new prosthetic leg. Some patients ("above-knee" amputees) may find it uncomfortable wearing or unable to afford the prosthetic leg, and thus they may opt to use wheelchair. The successful prosthetic leg users usually are able to wear their legs while carrying out daily activities, especially when they have good control over the prosthetic leg.

Nowadays, the technology for transfemoral prosthesis has reached a level where microcontroller is used to integrate sensory and actuation technology. This means, changes in the joint angle and body weight position can be detected by the leg to determine at what stage is the person walking, and appropriate control of the power driving the knee joint can be done to help perform the movement better. However, unlike our able foot, the prosthetic legs are still unable to know or sense the information from the environment such as the surface of

Assistant examining mySMART leg on a patient

the ground whether it is steep, inclined or rough, and the amputees are constrained to simple movements like walking and standing. Many commercially available transfemoral prosthetic knees from the US and other European countries, such as C-Leg, Genium knee, or Rheo Knee, are available to Malaysian users but the price is too costly. This specialized technology is available to limited number of users, with selected companies appointed for fitting and maintenance.

The UM Biomedical Engineering team has successfully developed a first prototype, which is feasibility proven, and has similar function like other available technologies. The novelty of mySMART leg technology is its ability to detect the activities of amputee purely from the socket itself, without using brain signals or electromyography signal, which requires additional placement of delicate electrodes in their day-to-day wearing of their prosthetic leg. The microcomputer in the mySMART Leg can determine the level and rate of knee actuation that is required to perform the movement.

There are two major novelty areas, i) the in-socket sensory system, and ii) the powered actuator, aimed to enable power generating activities such as stair climbing and sit-to-stand. In addition, by having 'in-house' control algorithm and technology, the research team will be more flexible in delivering the right service and technology, for the benefit of the amputee community. A commercial functioning prototype will be showcased in the near future.

The UM Biomedical Engineering team members consists of the Prosthetics & Orthotics engineers and Mechatronics engineers whom have close collaboration with the prosthetic leg users. Furthermore, the team has secured a collaboration with Ottobock Vienna and won a bronze medal in MTE 2016.

Bronze Medal in MTE 2016

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A Dual Function Anti Vibration System

It is a known fact that strong earthquakes can cause damage to civil engineering structures, which has made earthquake a major concern for structural engineers to develop efficacious design methods for the protection of buildings, residents and content against the destructive impacts of strong earthquake loading. The basics of seismic design have been to combine strength and malleability to withstand imposed loads and stop buildings from collapsing in case of an earthquake.

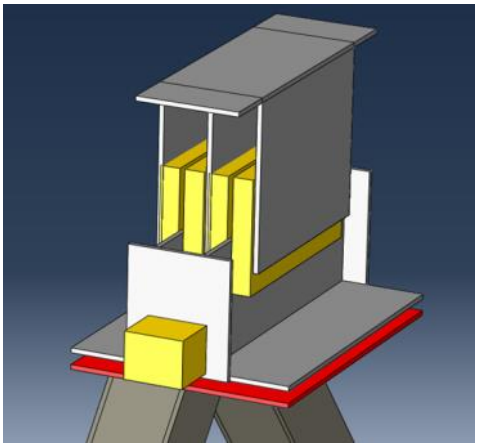

Fig. 1: Chevron viscoelastic damper

An earthquake resistant structure should have the necessary strength, rigidity, and ductility. It is accepted that steel structure systems are the one of the most suitable systems to comply with these requirements. Structural designers of earthquake-resistant reinforced concrete accept that reinforced concrete can behave similarly to steel from a ductility and strength perspective, but this behavior is very difficult to obtain, and requires special design and construction efforts.

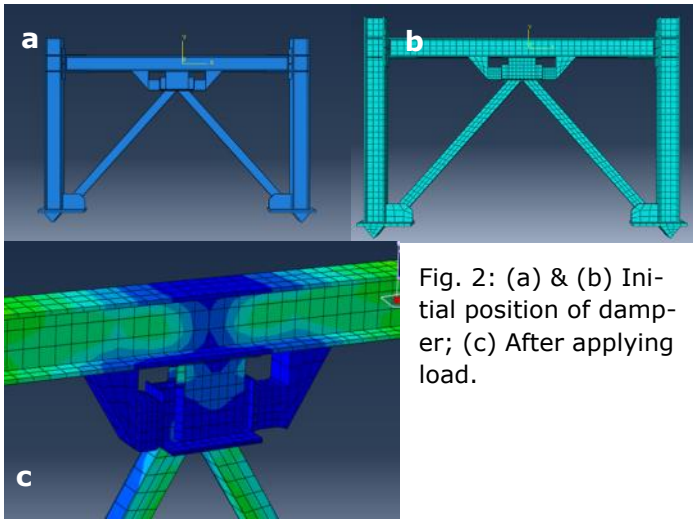

Fig. 2: (a) & (b) Initial position of damper; (c) After applying load.

The Chevron viscoelastic damper (CVD) is an innovative passive viscoelastic device that is capable of dissipating energy from a vibrating structure and also has a number of characteristics that can be especially relevant in practical implementations, such as low cost, design and implementation flexibility and conceptual simplicity. It is also suitable for both new and existing structures. The system is easily connected to existing frames through conventional construction techniques.

The damper consists primarily of four rubber pads surrounded by steel plates. The steel plates and rubber pads are joined together by special adhesives. The damper connects to the beam and chevron bracing, the rubber pads permitting relative movement along the direction of lateral force. Two rubber cubes also installed in each side of the damper for improving energy dissipation of the system. The damper is based on compression and tension concept in rubber cubes and shear in rubber pads. The details of damper are illustrated in Figure 1.

The initial position of the damper in steel frame can be seen in figure 2(a) & (b). When lateral load applies, the frame displaced along the loading direction and the rubber cube at one side subjected to compression and the other side go to tension along with the shear deformation in rubber pads. The deformed shape of the damper after applying lateral load is illustrated in figure 2(c).

To evaluate performance of Chevron Rubber damper device (CRD) due to earthquake excitation, a steel frame with pin supports equipped with Chevron rubber damper device is modelled by ABAQUS v6.12.3. The material and geometric nonlinearities are both considered in the FE

Table 1: Mechanical properties of the components of CVD.

Material	Young's modulus (MPa)	Poisson's ratio	Density (g/cm³)
Low carbon steel	210,000	0.3	7.85
Rubber (viscoelastic material)	1.35	0.49	0.91

models. Displacement was applied at top of the column along the horizontal direction to simulate the seismic forces.

Essentially, steel is the only material used for all the members in bare frame. Synthetic rubber material was used for modelling CVD. Corresponding Young's modulus, Poisson's ratio, and density of the above two parameters are shown in Table 1. In addition, any effects caused by temperature changes in the system are beyond the scope of this study and therefore not considered in the material model.

A comparison of the performance of bare frame and proposed system under monotonic loading can be seen in Figure 3. According to graph plotted CVD imposes a significant influence on the energy dissipation of wall panels. The area enclosed by the hysteresis curves is a measure of the energy dissipated by the system in resisting the cyclic loading.

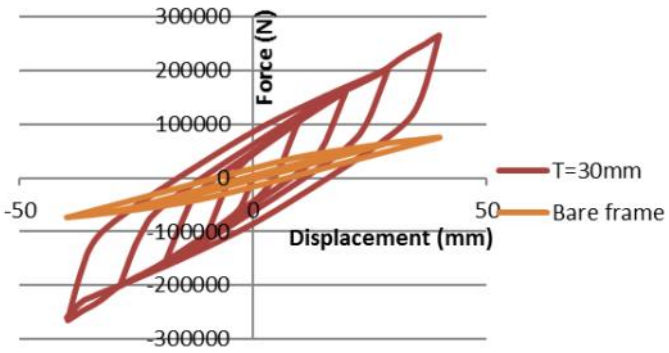

Fig. 3: Comparing hysteresis analysis.

The structural Pushover analysis (Fig. 4) assesses performance of the system by estimating the force and deformation capacity and seismic demand using a nonlinear static analysis algorithm. The base shear versus roof displacement for both bare frame and frame with CVD are generated.

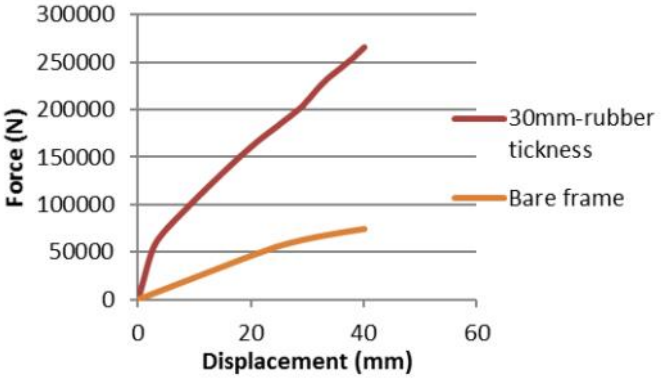

Fig. 4: Comparing pushover analysis.

Bronze Medal in MTE 2016

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ITEX 2016 Winners

Fig. 1: Gold award winners and representatives at ITEX 2016.

University of Malaya won a total of 9 awards at the International Invention & Innovation Exhibition (ITEX) 2016 that was held at KLCC on 12-14 May 2016.

ITEX is one of the largest invention exhibitions in the world showcasing the best inventions from Asia and Europe. It is an annual exhibition featuring 23 invention categories using innovative technology. This year's exhibition showcased over 1,000 inventions by local and international inventors, research scientists, research institutions, individual inventors, young inventors and corporations.

Six teams were selected to represent University of Malaya in ITEX 2016, in addition to three individual entries. A total of seven gold and two silver medals were awarded to University of Malaya. The details of the winning projects are as follows:

Gold Medal
Project : Low-Cost Desktop Portable Electrical Discharge Machine (PEDM)
Researchers : Dr. Azuddin Mamat (PI), Prof. Dr. Imtiaz Ahmed Choudhury, Prof. Dr. Zahari Taha, Dr. Yap Hwa Jen, Aznijar Ahmad Yazid, Muhammad Basril Muhammad Asri, Nurizaz Nadia Mohamad Jambri
Email: azuddin@um.edu.my

Gold Medal
Project : OsteoKneeTM
Researchers : Ir. Dr. Lai Khin Wee (PI), Dr. Goh Siew Li, Associate Prof. Ir. Dr. Belinda Murphy, Yong Ching Wai, Victor Kean Shern Phng, Haw Yu Hong
Email: lai.khinwee@um.edu.my

Gold Medal
Project : GreDSSC: Natural Polymer Electrolyte Based Dye-Sensitized Solar Cells for Green Future
Researchers : Dr. Ramesh Kasi (PI), Dr. Mo-

hammad Hassan Khanmirzaei, Prof. Dr. Ramesh T. Subramaniam, Dr. Vengadaesvaran Balakrishnan, Mr. Ng Hon Min, Mr. Mohd Zieauddin Kufian, Dr. Ezr Morris Abraham Gnanamuthu, Prof. Dr. Abdul Kariem Arof
Email: rameshkasi@um.edu.my

Gold Medal
Project : A New Intelligent Material for Radiation Detection- Germanium Flat Fiber (Ge-FF)
Researchers : Prof. Dato' Dr. Jamil Maah, Prof Yusoff Mohd Amin, Dr. Siti Fairus Abdul Sani, Siti Shafiqah Ahmad Shaharuddin, Siti Nurasiah Mat Nawi, Siti Rozaila Zahariman, Norfadira Wahib
Email: mjamil@um.edu.my; ctfairussani@gmail.com

Gold Medal
Project : Transition Metal Oxide Tetragonal Zirconia with Unique Elecrical and Mechanical Charateristics Produced by Microwave Technique
Researchers : Prof Dr. Ramesh Singh (PI), Assoc. Prof. Dr. Tan Chou Yong, Dr. Aliasghar Niakan, Prof. Dr. Mohd Hamdi Abdul Shukor, Prof. Dr. Ramesh T. Subramaniam, Ir. Dr. Ching Yern Chee
Email: ramesh79@um.edu.my

Fig. 2: Silver award winners at ITEX 2016.

Gold Medal
Project : Novel Technique to Fabricate High Aspect Ratio Micro-electrode for Producing Micro-Size Miniaturized Products
Researchers : Dr. Ahmed Aly Diaa Sarhan (PI), Mr. Mehdi Hourmand, Prof. Noordin Mohd Yusof, Dr. Mohd Sayuti Ab Karim
Email: ah_sarhan@um.edu.my

Gold Medal
Project : Atomatic Themocyclic Dipping Machine (ATDM)
Researchers : Prof. Dr. Mohd Hamdi Bin Abdul Shukor (PI), Dr. Noor Azizi Mardi, Dr. Mohd Sayuti Ab Karim, Dr. Bushroa Abd Razak, Dr. Siti Nurmaya Musa, Dr. Farazila Yusof, Mr. Mohd Fadzil Jamaludin, Mr. Ahmad Muhaimin
Email: hamdi@um.edu.my

Silver Medal
Project : Portable Volatile Organic Chemical Refiner
Researchers : Prof. Dr. Yatimah Alias (PI), Dr. Woi Pei Weng, Dr. Mehrdad Gholami
Email: yatimah70@um.edu.my; pmwoi@um.edu.my

Silver Medal
Project : BOOK SPOT! Learning Style based Information Seeking Tool
Researchers : Dr. Nor Liyana Mohd Shuib (PI), Nur Baiti Afini Normadhi
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IPPP Central Laboratory Facilities

FACILITIES	MODEL	TEST/SERVICES
Nuclear Magnetic Resonance (NMR 270 MHz)	JEOL 270 MHz	^{1}H, ^{13}C & others
Nuclear Magnetic Resonance (NMR 600 MHz)	Bruker AVANCE III 600 MHz	^{1}H, ^{13}C & 2D analysis
Sample Preparation (SEM)	Polaron CPD 7501 Critical Point Dryer Biorad Sputter Coater	Carbon/Gold Coating; Chemical Treatment /CPD
GCMS	7890A GC/ MS Agilent 5975 Shimadzu QP2010 ULTRA GCMS	Compositional Test (Scan & SIM Mode using RTX-5 Column); Compositional Test (Own Column)
Confocal Laser Microscope	Leica Tcs Sp5 Ii	Fluorescent Imaging; Life cell imaging (Time Lapse)
Field Emission Scanning Electron Microscope (FESEM-EDX)	Quanta FEG 450 EDX-OXFORD	Imaging; Compositional
Surface Area Analyzer (BET)	Micromeritics ASAP2020 TRISTAR II 3020 Kr	Surface Area; Pore Volume; Pore Size Distribution
Differential Scanning Calorimeter (DSC)	Perkin Elmer (DSC-8000)	Heat Flow Analysis; Specific Heat Capacity (Cp)
Simultaneous Thermal Analyzer (STA)	Perkin Elmer (STA-6000)	Weight Loss; Melting Curves
Dynamic Mechanical Analyzer	Perkin Elmer	Creep Test
Particle Image Velocimetry (PIV)	Dantec Dynamics Nano L135-15piv	2D & 3D Imaging
DNA Sequencer	Applied Biosystems (3730xl DNA Analyzer)	DNA Sequencing
Real Time PCR	Applied Biosystems Quantstudio (12k Flex Real Time PCR System)	Quantitative PCR Application
LCMS	Agilent Technologies	Qualitative
UHPLC	Agilent Technologies	Qualitative
Ellipsometer	J.A. Woollam M-2000	Change in Polarization; Optical Constant; Film Thickness
Rheometer	TA Instruments DHR-2	Viscosity; Viscoelastic
Tensiometer	Attension Sigma 700	Surface and Interfacial Tension; Powder Wettability

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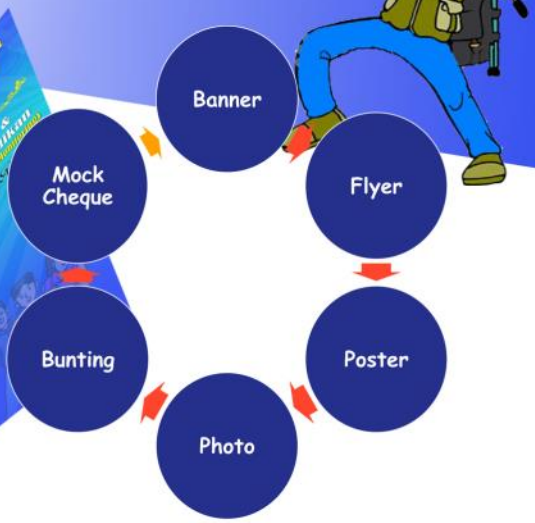

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